APPLIED RESEARCH REPORT

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4-9159

CORRELATION OF MINERAL, MACERAL AND PETROPHYSICAL CHARACTERISTICS OF COAL TO BENEFICIATION TECHNOLOGY

FINAL REPORT
DSS CONTRACT NO. [illegible]685-00106
OSQ

by:

THE ATLANTIC COAL INSTITUTE

for:

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Project: ACI 85-153
December 1986

303 pp

MICROMEDIA

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SUMMARY

1. An investigation was conducted on bituminous coal from Minto (New Brunswick), and the Hub Seam (Prince Mine, Cape Breton) to correlate mineral, maceral and petrophysical characteristics.

2. Pyrite was abundant in both bulk coals with well developed euhedral to subhedral crystals observed in the Minto/Chipman #2, while less mature crystals approaching globular form were observed in the Prince/Hub sample. Other minerals such as quartz, illite and kaolinite were abundant in both samples, often exhibiting lineation with bedding planes.

3. The most successful maceral separations were obtained using demineralized coal and $ZnBr_2$, and the following specific gravity fractions:
   1.25 float - exinite fraction
   1.35 float - vitrinite fraction
   1.45 float - inertinite fraction
   1.45 sink - mineral matter

4. Good separations were obtained for the exinite and vitrinite fractions; however, the inertinite fraction was diluted with vitrinite. Finer grinding may be necessary to liberate the inertinite macerals.

5. Hand-picked fractions were more successful than float-sink at concentrating the inert macerals, but were less successful at concentrating the exinite macerals. Hygrading by hand-picking followed by demineralization and float-sink using the recommended procedure is suggested to obtain highest maceral recoveries.

6. Plastometry, dilatometry and elemental analysis indicate that physical and chemical changes have occurred in both coals through time by the oxidation process.

7. Higher ash and sulphur and lower calorific values in the reanalysis of float-sink fractions from 1984 suggest that the most recent separations may not have been as efficient at separating the mineralogy from the coaly fraction. oxidation may also play a role in these differences.

8. Concentrating the heavy mineral fraction by low temperature ashing, followed by float-sink did not result in detection of such minerals as zircons and monazites. This suggests that these minerals are rare in the two coals studied.

9. Low temperature ashing does cause chemical changes in elemental ratios of some minerals such as pyrite.

1. INTRODUCTION

The Atlantic Coal Institute submitted a proposal on November 14, 1984, in response to a Request for Proposal RFP 15SQ23440-4-9159X to study the correlation of mineral, maceral and petrophysical characteristics of coal and coal fines to beneficiation technology. This project represents a modification from the original proposal with emphasis shifted to maceral concentration and characterization of maceral and mineral content for two seams, namely the Hub seam (Sydney Coalfield) and the Chipman #2 seam (Minto Coalfield).

This project was not activated until November, 1985, and subsequently was conducted during a most turbulent period in Canadian fossil fuel research. Major reductions in Federal Government contract research financing, plus a virtual halt in industrial research activity occurred with the oil price collapse of 1986. Small research groups such as the Atlantic Coal Institute experienced dramatic shifts in their financial affairs. As a result, the continuity in research staff could not be maintained. This project benefited from the input (albeit sporatic) of the following personnel:

Dr. D. Birk
Dr. P. Fung
J.C. Pilgrim
D. McMahon
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	Z-0001-N-R-D				

TITLE: CORRELATION OF MINERAL, MACERAL AND PETROPHYSICAL CHARACTERISTICS OF COAL TO BENEFICIATION TECHNOLOGY (50/50 Cost-shared Energy Conversion Program)

STATEMENT OF WORK

The Contractor shall undertake the work in accordance with Appendix "A", attached hereto.

PRIORITY OF DOCUMENTS

The documents listed below form part of and are incorporated into this contract. If there is a discrepancy between the wording of one document from the wording of any other document which appears on the list, the wording of the document which first appears on the list shall prevail over the wording of any document which subsequently appears on the list:

1. these articles of agreement
2. Appendix "A", Statement of Work
3. Appendix "C", Gen. Conditions, R&D
4. Appendix "B", Contract Plan
5. the Contractor's proposal
6. Appendix "D", Disclosures Cert.
7. Appendix "F", DSS Claim Form IIII
8. Appendix "E", Travel Guidelines

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RN: 23440-4-9159
FC: 234-131-000000-505701-0415

CONTRACT SERIAL NUMBER / NUMÉRO DE SÉRIE DU CONTRAT
OSQ85-00106

CAPITAL – FACTURE 04/06: $120,000.00 /10	EST. EXPENDITURE – MONTANT EST. $120,000.00 (subject to the ceiling price)	OCT 23 1985 YEP – LAP B1P	FOR THE DEPARTMENT – POUR LE MINISTÈRE SIGNATURE

DSS-MAS 1100E (10/83)

APPENDIX "A"

STATEMENT OF WORK

Objectives:

1. Laboratory investigation of two Eastern Canadian coals at 1mm to 1 micron particle size to define mineral and maceral characteristics.

2. Application of high purity mineral and maceral group separation to the factors relevant to coal washability.

3. Application of scanning electron microscopy and energy dispersive x-ray microanalysis to coal minerals and macerals.

4. Investigate the relationship between fluidity (Gieseler plastometry and/or Audibert-Ariau dilatometry) dilatometric measurements of the coals and the washability.

Background:

Coal is a heterogeneous fuel comprising organic macerals and mineral matter. The increasing utilization of high sulphur or low-grade coals demands an investigation into methods of upgrading or beneficiating the fuel effectively and economically.

Adorjan under contract to CANMET (contract EMR-83-0046) has reviewed the literature on mineral beneficiation as applied to coal preparation. His recommendations for research included coal petrography, particulate behavious and mineralogy at various stages of beneficiation.

This study aims to address these factors by studying two eastern Canadian coals (both run-of-mine and fines). It will provide basic information on the coals relevant to the design and performance predictions of beneficiation processes.

Tasks:

1. Collection of representative samples of fines and run-of-mine two Eastern Canadian coals. The coals will be obtained from Minto, N.B. (high volatile bituminous seam) and Prince, N.S. mines.

2. Determination of the washability of both coals (as received) and fines by standard sink-float techniques.

3. Determination of the Gieseler fluidity and/or dilatometric measurements of the raw coal samples and various fractions from task 2.

4. Development of maceral separation technique. This will be based on the methodology developed at Argonne National Laboratory. (Dyrkacz and Horwitz, 1982). Twenty samples of each coal will be separated into various density fractions using density gradient centrifugation of ultra-fine coal. A number of these fractions will be analyzed by petrographic microscopy, scanning electron microscopy with x-ray microprobe analysis and standard fuel techniques (e.g. ultimate analysis).

5. Development of scanning electron microscopy with energy dispersive x-ray (EDX) techniques or methods for the study of coal minerals in situ. Sixty samples (30 for each coal) will be studied to develop a method of determining the distribution of minerals in raw coal. The coals will be analysed for maceral content as well as by standard coal techniques. Enhancement of mineral concentration will be by low temperature ashing techniques or backscattered electron imaging.

6. The submission of monthly reports to the Scientific Authority detailing the progress made as well as any difficulties encountered. The report shall include some results.

7. The final report shall be submitted at the end of the contract and shall include the following:

1) Results of the washability studies of the raw coals.

2) A detailed description of the method used and developed for the separation of coal macerals/density fractions. Results of the study of the different density fractions including a range of electron and optical micrographs.

3) A detailed description of the techniques and methods used for the scanning electron microscopy and EDX analysis of minerals in the coal samples.

4) Correlation of results as they relate to the beneficiation of the fuel. This will involve analysis of the mineral distribution and the spatial relationship with the coal macerals with respect to the minerals.

5) Correlation between fluidity washability will be investigated.

3. ANALYTICAL PROGRAMME

3.a. SAMPLE COLLECTION AND BULK PREPARATION

Two run of mine (ROM) samples of approximately 100 kg were collected during the period of April 5 to May, 1984. One sample was collected from the Hub seam at the Prince mine location, in the Sydney Coalfield, Cape Breton, Nova Scotia. The second sample was collected from the Chipman #2 seam at the strip mine location, in the Minto Coalfield, Minto, New Brunswick. Each sample was stored in five airtight 6.5 gallon polyethylene Can-Am containers purged with nitrogen.

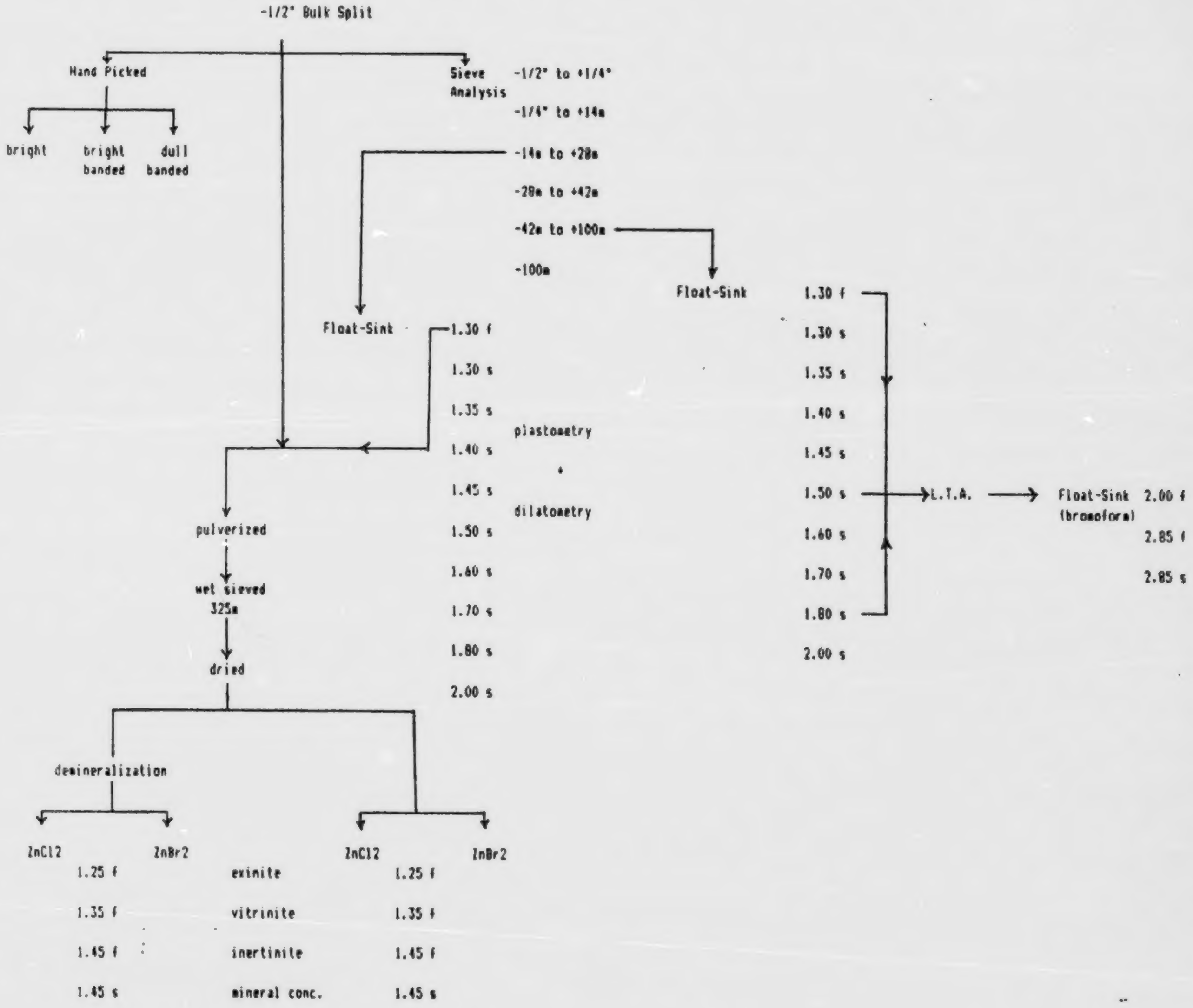
The bulk sample preparation was completed at SGS Supervision Inc. (Sydney). Each sample was air dried, hand crushed to pass two inches, and then sieved (Tables 1 & 2, Appendix IA). The sample was recombined, crushed to -1/2 inch and then split into subsamples for further processing.

The remaining sample preparation was completed in-house using a Straub grinding mill, a Holmes pulverizer, and a Ro-tap sieve shaker. Various splits and size fractions were prepared for the analytical programme (Flow chart, figure 1).

3.b. PROXIMATE ANALYSIS

Proximate analysis was carried out using a Fisher Model 490 Coal Analyser. Approximately 1 gram of -60 mesh coal was

FIGURE 1. Flow Chart



-1/2" Bulk Split
Hand Picked
bright
bright banded
dull banded
Sieve Analysis
-1/2" to +1/4"
-1/4" to +14m
-14m to +28m
-28m to +42m
-42m to +100m
-100m
Float-Sink
1.30 f
1.30 s
1.35 s
1.40 s
1.45 s
1.50 s
1.60 s
1.70 s
1.80 s
2.00 s
plastometry
+
dilatometry
pulverized
wet sieved 325m
dried
demineralization
ZnCl2
ZnBr2
1.25 f
1.35 f
1.45 f
1.45 s
exinite
vitrinite
inertinite
mineral conc.
ZnCl2
ZnBr2
1.25 f
1.35 f
1.45 f
1.45 s
Float-Sink
1.30 f
1.30 s
1.35 s
1.40 s
1.45 s
1.50 s
1.60 s
1.70 s
1.80 s
2.00 s
L.T.A.
Float-Sink (bromoform)
2.00 f
2.85 f
2.85 s

weighted into a fused quartz crucible to the nearest 0.1 mg. The sample was then placed in a drying oven at 107°C for one hour, cooled and reweighed. The residual moisture content was calculated from the difference in weight of the coal sample before and after drying.

The crucible and dry coal were covered with self-sealing quartz covers and placed in the Coal Analyser muffle furnace at 600°C. The sample was heated to 950°C at the rate of 35°C per minute and maintained at 950°C for 7 minutes. The sample was cooled to room temperature and reweighed. The difference between the dry coal and the residue after heating to 950°C is used to calculate the volatile matter content.

The ash content was determined by placing the crucible and residue in the cold muffle furnace and heating to 750°C at the rate of 35°C per minute until a constant weight was reached. The crucible was cooled to room temperature and reweighed. The difference in weight between the dry coal and the ash product is used to calculate the ash content.

The fixed carbon content is calculated using the following equation:

$$FC = 100\% - (\%\ \text{volatiles} + \%\ \text{ash} + \%\ \text{moisture}).$$

Where only the ash analysis was required (float-sink fractions and sieve fractions), the same procedure was followed in loading crucibles, but the heating rates were modified to compensate for volatile matter. The coal was placed in a cold muffle furnace and heated to 500°C at the rate of 10°C per minute. The sample was further heated to 750°C at a rate of 12°C per minute and maintained at 750°C for 4 hours until a constant weight was reached. The samples were cooled to room temperature and reweighed. The percent ash was calculated from the difference in the weight of the coal and the weight of the final ash product.

3.c. ULTIMATE ANALYSIS

For carbon, hydrogen, nitrogen, and oxygen analysis, approximately 0.8 mg of standards and samples were weighed into tin (for CHN) and silver (for O) capsules using a Mettler UM3 Ultramicrobalance. The samples were then loaded into the autosampler of the 1106 Carlo Erba Elemental Analyzer from which they dropped at preset times into a combustion tube.

CHN

The combustion tube for CHN analysis was maintained at 1030°C. The constant flow of helium through the tube was temporarily enriched with oxygen as each sample dropped for flash combustion. The combustion gases were reduced by passing them over copper at 650°C. The resulting gases were then separated in a Porapak QS chromatographic column maintained at 100°C into N_2, CO_2, and H_2O.

Oxygen

The combustion tube for oxygen analysis was maintained at 1060°C. A constant flow of helium carried the pyrolysis gases into a 5 A Molecular Sieve chromatographic column maintained at 100°C which separated the gases into N_2, CH_4, H_2 and CO.

At the end of the chromatographic column, a TCD detector produced an electrical signal proportional to the concentration of the gas. This signal was then passed on to a Spectra Physics 4270 integrator which calculated the area under the curve. The concentration was then calculated using the following equations.

1) K-FACTOR CALCULATION
The K-Factor was calculated for each element according to the following equation:

$$K = \frac{\%\ t \times WS}{1}$$

where: % t = Theoretical percentage of the standard
Ws = Weight of the standard in mg
1 = Standard integral

2) PERCENTAGE CALCULATION
The percentage of each element to be determined was calculated according to the following equation:

$$\% = \frac{K \times 1}{W}$$

where: K = Average factor of each element
1 = Sample integral
W = Weight of sample in mg

3.d. GROSS CALORIFIC VALUE

The calorific value of the samples were determined using a Digital Data Systems CP500 Isothermal Calorimeter in accordance with ASTM designation D3286-82. A 0.5g sample of coal was burned in an oxygen bomb under 3000 KPa of oxygen. The coal was ignited and a temperature rise, which was representative of the calorific value was measured. The calorific value was calculated by a microprocessor in the instrument and was directly reported in BTU/lb. This value was then corrected for sulphur as per ASTM D3286-82.

3.e. TOTAL SULPHUR

The total sulphur content was determined using a Leco Model 521 induction furnace sulphur determinator. A 0.1 gram sample of -60 mesh coal is burned in a combustion tube, and the SO_2 gas yielded in combustion is retained in a dilute HCl solution. The solution is titrated to endpoint using KIO_3 with a starch indicator. The sulphur content is calculated using the following equation:

$$\% S = \frac{A}{B} \times K$$

Where: A = mls KIO_3
B = weight of coal in grams
K = determination factor (constant)

3.f. PLASTOMETRY

The plastic properties of each coal sample were measured using a Standard Instrumentation P11R constant-torque Gieseler Plastometer in accordance with the ASTM standard D2639-74. A constant torque of 16g/cm was applied on a stirrer placed in a crucible packed with 5.0g of -40 mesh coal sample. The crucible was immersed in a molten solder bath at a temperature of 330°C. The temperature was increased by 3°C/min. to 520°C. The rates of movement of the stirrer were recorded as initial softening temperature, (maximul fluid temperature) solidification temperature (temperature when movement stops and the coal has formed coke) and the maximum fluidity (dial divisions per minute).

3.g. DILATOMETRY

The Audibert Arnu dilatometer was used to calculate the dilatation of each of the samples. Two pencils made of -42 mesh coal were heated simultaneously under a load in a tube with a temperature increase of 3°C/minute according to specifications. Contraction and dilatation were measured as a percentage of the length of the coal pencil used. The dilatation value is a measure of the "coking ability" of the coal. In addition, the G factor or coking capacity was calculated using the following formula:

$$G = \frac{E + V}{2} \times \frac{K + D}{VK + ED}$$

where: G = G factor
K = contraction (%)
D = dilatation (%)
E = softening temperature (C)
V = resolidification temperature (C)

3.h. FLOAT-SINK ANALYSIS

Float-sink analysis was completed on two selected sieve fractions: -14m to +28m and -42m to +100m; following the CANMET procedure EMR 67/142 (Picard and Rosenhart, 1966). Each sieve fraction was separated into 10 float-sink fractions: 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70, 1.80 and 2.00. The -14m to +28m sieve fraction was separated in large steel beakers, and the finer -42m to +100m sieve fraction was separated using separator funnels. Ash, sulphur and calorific value analyses were completed on each float-sink fraction and appear in Tables 41 to 44, Appendix I.C. Carbon, hydrogen, nitrogen and oxygen analyses as well as plastometry and dilatometry were also completed on these fractions and results can be found in Appendix I.C.

3.i. DEMINERALIZATION OF COAL FINES

A split of each of the -1/2" subsample, pulverized to -325 mesh was demineralized using the following procedure:

Five to ten grams of the dry samples were weighed into 250 ml polycarbonate centrifuge tubes. One to two mls of ethanol were added to each sample to wet the coal and 40mls of 10% hydrochloric acid was added. The sample was stirred well and let sit overnight. The clear top portion was decanted and the sample was then rinsed with distilled water until the decanted solution was a neutral p.H. This process needed approximately three rinsings to obtain a neutral p.H. After each rinse the sample was centrifuged at 4000 rpm for 5 minutes prior to decanting. Forty mls of concentrated hydrofluoric acid was added to the sample in the centrifuge tube, stirred well and let stand overnight. The hydrofluoric acid was then decanted, the sample rinsed with distilled water and let stand until separation was observed. The rinsing was then repeated three more times using centrifugation to speed the settling process. Forty mls of 10% hydrochloric acid was added again and let stand overnight prior to decanting. The sample was then rinsed and centrifuged five more times until a neutral p.H. was observed in the decanted solution. The demineralized coal was then dried at 60°C in a nitrogen atmosphere.

3.j. MACERAL SEPARATION

The maceral separation technique was established through trial and error using two heavy liquid media, zinc chloride and zinc bromide, at specific gravities of 1.25, 1.35 and 1.45. All samples were pulverized in a Spex ball mill to pass a 325 mesh screen. Experiments were completed on -1/2" subsamples using both mineralized and demineralized fractions as well as the 1.30 float fraction from the -14m to +28m sieve fraction. Results of maceral separations can be found in Tables 9 to 29, Appendix I.A. and Tables 49 and 50, Appendix I.C.

The procedure which gave the most promising results is as follows:

1. A split of the coal was demineralized using hydrochloric and hydrofluoric acids (see procedure 3.i.).

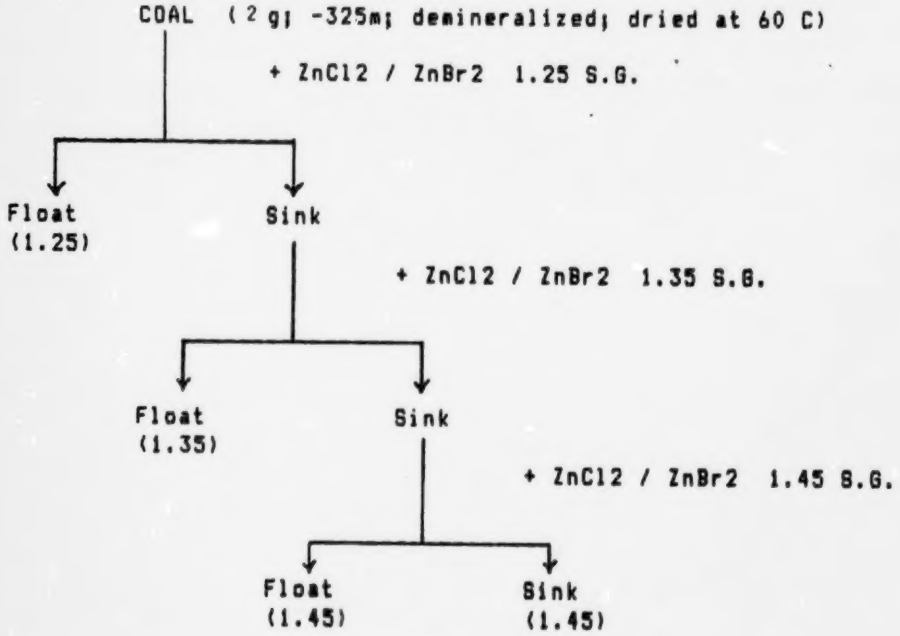
2. Two grams of this demineralized coal was then added to a Waring Commercial Blender containing 125ml of 1.25 s.g. solution and a squirt of Darvan #4 dispersant. The solution was mixed for five minutes.
3. The solution was poured into a test tube and centerfuged at 10,000 r.p.m. for twenty minutes.
4. The float portion was decanted and filtered to recover the 1.25 floats. This fraction was washed with 150-200ml of water to remove the chlorides.
5. The sink portion was also washed and then placed in 1.35 s.g. solution, and the procedure repeated until the 1.45 floats and sinks were retrieved (see Flow Chart, Figure 2).

3.k. LOW TEMPERATURE ASHING (L.T.A.)

Low temperature ashing was completed on three float-sink fractions from the -42 to +100m sieve fraction using an SPI Plasma Prep II low temperature asher from Structure Probe Inc. (West Chester, Pennsylvania). This unit was a single chamber of pyrex glass and a variable radio frequency power of 0-100 watts provided by a crystal controlled oscillator operating at 13.56 MHz.

A sample of several grams of -42 to +100 mesh coal was weighed into a pyrex watchglass and inserted into the chamber. Using a 5 psi oxygen atmosphere at approximately

FIGURE 2. Maceral Separations


COAL (2 g; -325m; demineralized; dried at 60 C)
+ ZnCl2 / ZnBr2 1.25 S.G.
Float
(1.25)
Sink
+ ZnCl2 / ZnBr2 1.35 S.G.
Float
(1.35)
Sink
+ ZnCl2 / ZnBr2 1.45 S.G.
Float
(1.45)
Sink
(1.45)

1.0 Torr, the sample was oxidized for 9 to 11 days at a power setting of 4-5 (80 - 100 watts). The sample was stirred daily and ashed to completion.

Finkelman and Gluskoter (1981) summarized the problems inherent to the LTA technique:

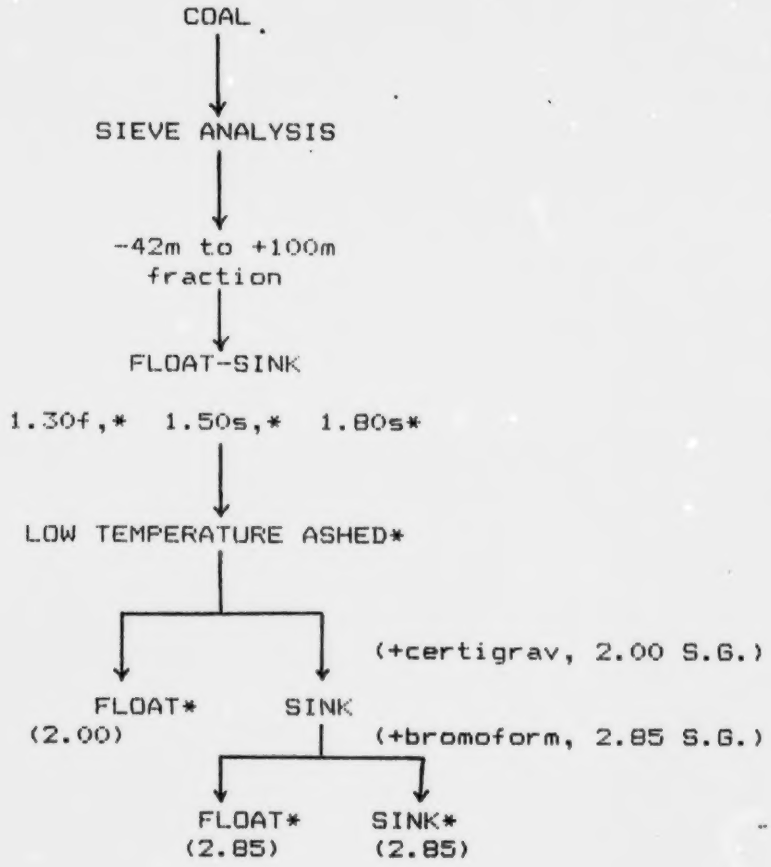
1. Several days required to ash a few grams of coal
2. Organo-metallic complexes are destroyed
3. Artificats of CaSO4, NaSO4, oxalates and nitrates are created
4. Clays are structurally altered
5. Xray amorphous material is produced (up to 20%)

3.1. LOW TEMPERATURE ASH MINERAL SEPARATIONS

Varying sample weights between .5g and 1.5g (depending on the amount of LTA available), were placed in a test tube which was filled with Certograv (S.G. = 2.0) and agitated until the sample was well mixed. The samples were then placed in a test-tube rack until a clean separation of float and sink materials were observed. A syringe was used to syphon off the float material and the Certograv was evaporated off the float and sink material overnight, at room temperature. Bromoform (2.85 S.G.) was then added to the sink material of the first separation and agitated until the material was well mixed. The samples were placed in test-tube rack until a clean separation of float and sink material was observed. A syringe was then used to syphon off the float material and the bromoform was evaporated off the float and sink material overnight. Figure 3 outlines the procedure for low temperature ash mineral separations.

FIGURE 3.

LOW TEMPERATURE ASH MINERAL SEPARATIONS


COAL
SIEVE ANALYSIS
-42m to +100m fraction
FLOAT-SINK
1.30f,* 1.50s,* 1.80s*
LOW TEMPERATURE ASHED*
(+certigrav, 2.00 S.G.)
FLOAT* (2.00)
SINK
(+bromoform, 2.85 S.G.)
FLOAT* (2.85)
SINK* (2.85)

*Mineral analysis completed with SEM-EDX.

3.m. ROCK-EVAL ANALYSIS

A Delsi Oil-Show Analyzer was used to obtain Rock-Eval Data on the various hand-picked, $ZnCl_2$ and $ZnBr_2$ separations. Results were compared with an in-house oil shale standard calibrated against a Delsi source rock standard (certified by the Institute Francais du Petrole (IFP) Paris, France).

The samples were run using the following parameters:

1. Pyrolysis Cycle 1 - Gas purge at 90°C for 2 minutes, 300°C uinitial isotherm for 2 minutes, 30°C/min. temperature gradient and 600°C final oven temperature.
2. Attenuation Scale - 1/64, 1/128
3. Chart Drive - 2 mm/min.
4. Gases - U.H.P. Helium: for Pyrolysis, Purge and Carrier
   - Zero Air: for Oxidation in T.O.C. oven and for the F.I.D. detector.

Abbreviations used in the data table are as follows:

S_0, S_1: purge peaks (gas, oil)

S_2 : pyrolysate peak (kerogen)

Tmax : temperature at peak max. of S_2

T.O.C.: total organic carbon

O.P.I.: oil production index

H.I. : hydrogen index

The standard (in-house) was checked at the beginning and end of each run to determine the deviation caused by running such rich samples.

3.n. COAL PETROGRAPHY

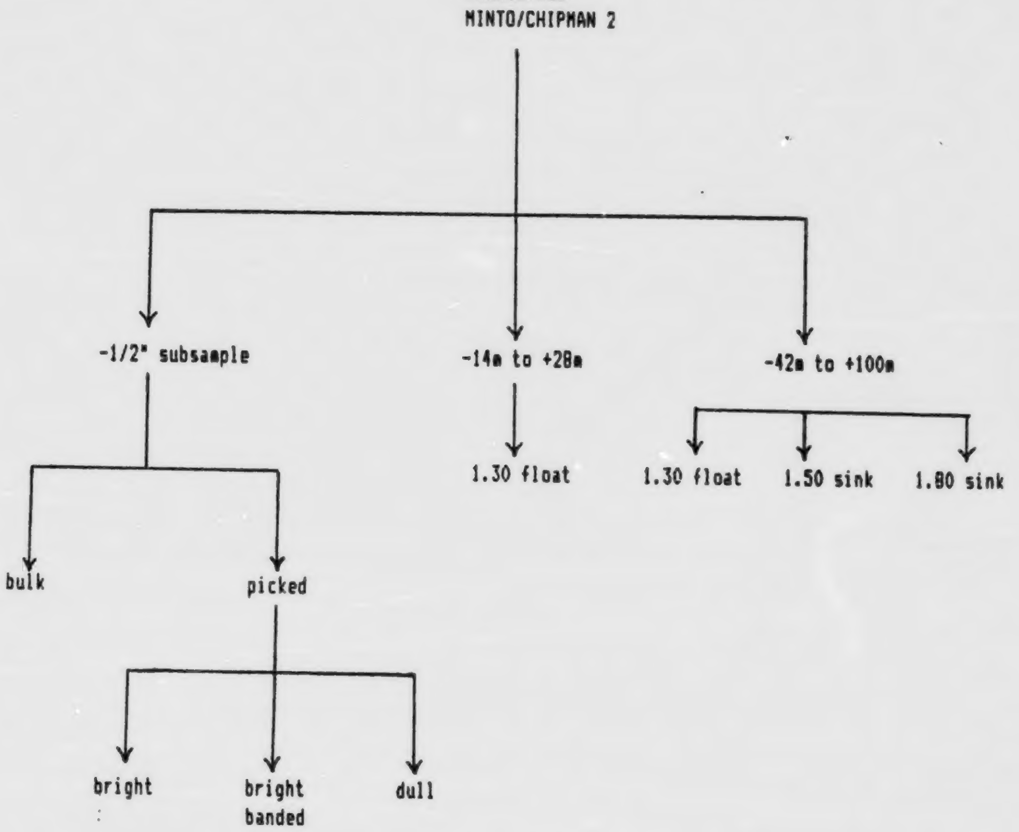
i) Introduction

Coal petrology is the study of the organic and inorganic components of coal to characterize origin, geological history, and petrophysical properties (Bustin et al., 1983). The key approach to coal petrology is the petrographic analysis of coal by optical microscopy. Microscopic analyses of coal pellets for this study were made with a Zeiss Universal reflected light microscope equipped with a photometer and photomultiplier. Microscopic analyses were completed following ASTM recommendations using internationally recognized terminology (ICCP 1963, Bustin et al., 1983).

3.n. ii) Sample Preparation

Coal pellets were prepared from splits of coal in accordance with ASTM method D2797-72. Figure 4 illustrates the size fractions examined from each sample. Coarse samples were stage crushed to -20 mesh and mounted as a 25mm pellet with acrylic lucite transoptic powder in an automatic Metaserv mounting press. Pulverized float-sink fractions were mounted as received. The resultant coal pellets underwent three grinding stages using 240, 400 and 600 grit adhesive backed grinding papers attached to Metaserv grinding laps. This was followed by two polishing stages, first with

FIGURE 4. Samples analysed for maceral composition using the Petrographic microscope.


PRINCE/HUB
MINTO/CHIPMAN 2
-1/2" subsample
-14m to +28m
-42m to +100m
1.30 float
1.30 float
1.50 sink
1.80 sink
bulk
picked
bright
bright banded
dull

polishing cloth and 0.3 um alumina powder suspended in distilled water, followed by double layered silk and 0.05 um alumina powder suspended in distilled water. This procedure results in a fine polished surface suitable for microscopic examination of both the organic macerals and inorganic minerals.

3.n. iii) Group Maceral Analysis

Coal is composed of a number of microscopically recognizable organic entities called macerals, each with their own distinctive properties. Three principle maceral groups in increasing order of carbon content are: exinite, vitrinite, and inertinite. These maceral groups can be subdivided into a number of macerals as illustrated in Table 1.

The point count method (ASTM D2799-72) was used by attaching a Swift point counter and automatic stage to a Zeiss Universal petrographic microscope. Maceral determinations were made at 500x under immersion oil ($n^{25^{\circ}C}$= 1.5150). A cross-hair graticule was used, and the maceral counted was the maceral that lay directly under the cross-hair. Traverses were made across the pellet at 0.5mm increments. The point to point distance was also 0.5mm. A total of 500 points was counted for each bulk coal sample, and the volume percents were calculated and recorded in Tables 4 and 5, Appendix I.A. Maceral composition was also used to assess the maceral separation techniques both on

Table 1.

(taken from Bustin *et al.*, 1983)

MACERAL GROUP	MACERAL	ORIGIN	PETROLOGIC FEATURES
Vitrinite	Telinite	woody tissues bark	exhibits cell walls
	Collinite	woody tissues,	cell fillings, structureless vitrinite
Exinite or Liptinite	Sporinite	pollen, spores	individual bodies with distinct cell walls, high relief
	Cutinite	cuticles	serrated edges, high relief
	Resinite	resins; waxes	secondary cell filling, often zonation and internal reflections
	Alginite	algae	individual bodies or colonies
Inertinite	Fusinite	woody tissues	high reflectance, colour white to yellowish open cell lumina, thin cell walls, "bogen" structure
	Semifusinite	woody tissues	reflectance between vitrinite and fusinite, smaller cell lumina or closed, often cloudy appearance, anisotrophic
	Macrinite	uncertain, probably formed through oxidation of gelified plant material	amorphous bodies of irregular shape - high reflectance
	Micrinite	secondary maceral, genesis in part related to occurrence of liptinite macerals	small size, ca. 1 micron, granular appearance, high reflectance
	Sclerotinite	fungal mycelia, spores	cellular structure high reflectance
	Inertodetrinite	fragments of other inertinitic macerals	

hand-picked fractions, and float-sink fractions. Here the total number of counts reflected the amount of sample available. Results can be found in Appendix I.B. and I.C. respectively. Maceral analyses was also used to determine the efficiency of maceral separations using $ZnCl_2$ and $ZnBr_2$. These results can be found in Appendix I.A.

3.n. iv) Vitrinite Reflectance

Vitrinite reflectance determinations were made on bulk splits of each sample in accordance with ASTM method D 2798-72 using a Zeiss Universal petrographic microscope equipped with photometer and digital photomultiplier indicator. A monochromatic filter which passes light of 546nm wavelength was mounted between the sample and photometer. The coal pellet was scanned along tranverses and measurements were taken on small areas of vitrinite. The stage was rotated 360° and the maximum reading was recorded ($R_o$max). For each sample, a total of 50 vitrinite grains were identified and measured for reflectivity, to obtain a statistical assessment of the maximum. Histogram plots of maximum reflectance readings are found in figures 5 and 6, Appendix I.A. Data Table 6 contains a listing of measured values for each sample.

3.o. COAL MINERALS PROGRAMME: SEM-EDX-AIA

i) Introduction

Mineral matter in coal has traditionally been characterized by analyses of coal ash for the major oxides. Sprunk and O'Donnell (1942) recognized that such ash analyses cannot identify the original mineral matter, especially the microscopic forms. They conducted optical microscopic investigations on some 3000 thin sections from 100 coal beds to illustrate the mineral-maceral associations. Their survey identified the following minerals in coal:

A. Common Minerals (abundance order):

1. Kaolinite
2. Pyrite
3. Calcite
4. Quartz
5. Siderite

B. Accessory Minerals (some coals):

Apatite
Zircon
Feldspar
Garnet
Harnblende
Muscovite
Epidote
Biotite
Augite

Kyanite
Rutile
Staurolite
Topaz
Tourmaline
Chlorite
Sphalerite
Hydromuscovite
Limonite

Table 2. from Elliot (1981) illustrates a more comprehensive list of minerals identified in coals.

Gluskoter (1975) outlined a new procedure of isolating the minerals from coal by electronic radiofrequency ashing in an oxygen atmosphere at low temperature (<150°C). Scanning electron photomicrographs were reported for such LTA ashed pyrite, kaolinite, sphalerite, and galena.

Table 2 from: ELLIOTT (1981)

Minerals Identified with Coals

Mineral	Formula
Clay minerals	
Montmorillonite	$Al_2Si_4O_{10}(OH)_2 \cdot H_2O$
Illite-sericite	$KAl_2(AlSi_3O_{10})(OH)_2$
Kaolinite	$Al_4Si_4O_{10}(OH)_8$
Halloysite	$Al_4Si_4O_{10}(OH)_8$
Chlorite (prochlorite, penninite)	$Mg_5Al(AlSi_3O_{10})(OH)_8$
Mixed-layer clay minerals	
Sulfide minerals	
Pyrite	FeS_2
Marcasite	FeS_2
Sphalerite	ZnS
Galena	PbS
Chalcopyrite	$CuFeS_2$
Pyrrhotite	$Fe_{1-x}S$
Arsenopyrite	$FeAsS$
Millerite	NiS
Carbonate minerals	
Calcite	$CaCO_3$
Dolomite	$(Ca, Mg)CO_3$
Siderite	$FeCO_3$
Ankerite (Ferroan dolomite)	$(Ca, Fe, Mg)CO_3$
Witherite	$BaCO_3$
Sulfate minerals	
Barite	$BaSO_4$
Gypsum	$CaSO_4 \cdot 2H_2O$
Anhydrite	$CaSO_4$
Bassanite	$CaSO_4 \cdot 1/2H_2O$
Jarosite	$(Na, K)Fe_3(SO_4)_2(OH)_6$
Szomolnokite	$FeSO_4 \cdot H_2O$
Rozenite	$FeSO_4 \cdot 4H_2O$
Melanterite	$FeSO_4 \cdot 7H_2O$
Coquimbite	$Fe_2(SO)_3 \cdot 9H_2O$
Roemerite	$FeSO_4 \cdot Fe_2(SO_4)_3 \cdot 12H_2O$
Mirabilite	$Na_2SO_4 \cdot 10H_2O$
Kieserite	$MgSO_4 \cdot H_2O$
Sideronatrite	$2Na_2O \cdot Fe_2O_3 \cdot 4SO_3 \cdot 7H_2O$
Chloride minerals	
Halite	$NaCl$
Sylvite	KCl
Bischofite	$MgCl_2 \cdot 6H_2O$
Silicate minerals	
Quartz	SiO_2
Biotite	$K(Mg, Fe)_3(AlSi_3O_{10})(OH)_2$
Zircon	$ZrSiO_4$
Tourmaline	$Na(Mg, Fe)_3Al_6(BO_3)_3(Si_6O_{18})(OH)_4$
Garnet	$(Fe, Ca, Mg)_3(Al, Fe)_2(SiO_4)_3$
Kyanite	Al_2SiO_5
Staurolite	$Al_4FeSi_2O_{10}(OH)_2$
Epidote	$Ca_2(Al, Fe)_3Si_3O_{12}(OH)$
Albite	$NaAlSi_3O_8$
Sanidine	$KAlSi_3O_8$
Orthoclase	$KAlSi_3O_8$
Augite	$Ca(Mg, Fe, Al)(Al, Si)_2O_6$
Hornblende	$NaCa_2(Mg, Fe, Al)_5(Si, Al)_8O_{22}(OH)_2$
Topaz	$Al_2SiO_4(OH, F)_2$
Oxide and hydroxide minerals	
Hematite	Fe_2O_3
Magnetite	Fe_3O_4
Rutile	TiO_2
Limonite	$FeO \cdot OH \cdot nH_2O$
Goethite	$FeO \cdot OH$
Lepidocrocite	$FeO \cdot OH$
Diaspore	$AlO \cdot OH$
Phosphate minerals	
Apatite (fluorapatite)	$Ca_5(PO_4)_3(F, Cl, OH)$

Greer (1977a, 1977b, 1978) used scanning electron microscopy to characterize coal microstructure and pyrite inclusions using gold coated fracture surfaces. He demonstrated that a portion of the "organic" sulphur reported from ASTM procedure D2492 is likely attributable to pyrite crystallites and 10-40 micron framboids encapsulated by organic particles passing a 60 mesh screen ($\leq$ 250 microns). In Greer (1977b) he reported the morphology of pyrites within the coalified plant fibers as framboidal cell fillings, cleat crystals, polycrystallites, and collidal overgrowths. Pyrite distribution with depth in a seam were documented by Greer (1978a, 1978b).

Finkelman and Stanton (1978) used an SEM-EDX system on polished blocks, pellets and LTA ash to characterize the highly reflective grains in carbominerite bands. A list of their mineral findings in LTA are given in Table 3. The most abundant accessory minerals reported were: rutile, zircon, rare-earth minerals.

Staton and Finkelman (1979) has reviewed the characterization of both coal minerals and macerals by SEM-EDX. For the study of minerals, the SEM is ideal by virtue of magnification range, resolution, and atomic number sensitivity. Macerals, on the otherhand, are indistinct when polished pellets are observed. The correlation of optical microscopic and SEM fields of view is, therefore, recommended for a more complete assessment. Likewise, Finkelman and Gluskoter (1981) have reviewed the problems of mineral characterization by a variety of techniques. They conclude that:

Table 3 - Coal Minerals

From: Finkelman (1978)

- Accessory phases in the Waynesburg Coal -

"allanite" (REE silicate)
"apatite" ($(Ca_5(PO_4)_3(OH))$)
"barite" ($BaSO_4$)
*biotite (K-Fe-Al silicate)
*calcite ($CaCO_3$)
"chalcopyrite" ($CuFeS_2$)
*chlorite (Fe-Al silicate)
"clausthalite" (PbSe)
*diopside ($CaMgSi_2O_6$)
"gold" (Au)
*hornblende (complex silicate)
*hypersthene ($((MgFe)_2Si_2O_6)$)
"ilmenite" ($FeTiO_3$)
iron oxides
*magnetite (Fe_3O_4)
*marcasite (FeS_2)
*microcline ($KAlSi_3O_8$)
"monazite" ($CePO_4$)
*plagioclase ($((Na,Ca)(Al,Si)_4O_8)$)
*rutile (TiO_2)
*siderite ($FeCO_3$)
"sphalerite" (ZnS)
"sphene" ($CaTiO_5$)
*sylvite (KCl)
*talc (Mg-silicate)
*thenardite (Na_2SO_4)+
*tourmaline (borosilicate)
"xenotime" (YPO_4)
*zircon ($ZrSiO_4$)
—— nickel silicate
—— Fe, Cr oxide (?)
—— lead tungstate (?)
—— calcium sulfate+

" " - identification based primarily on major-element data
* - identification confirmed by X-ray powder pattern
+ - probably created during the low-temperature ashing process
—— - insufficient information for mineralogical identification

From: Finkelman and Stanton (1978)

Accessory phases in the low-temperature ash of the Waynesburg coal

Accessory phase	Comments
Amphibole	See text
Biotite	
Bloedite	$Na_2Mg(SO_4)_2 4H_2O$ associated with sylvite
Calcite	Some have detectable Mg and Fe
Calcium sulphate (?)	Probably gypsum created during ashing process
Chlorite	
Diopside	
Hypersthene	
Ilmenite	
Iron oxides	Amorphous to X-rays (?)
Magnetite	Authigenic, detrital, and extraterrestrial
Marcasite	Framboid
Microcline	
Plagioclase	
Rutile	
Siderite	Some have detectable Mn
Sylvite	KCl, associated with bloedite
Talc	
Thernardite	Probably created in ashing process
Tourmaline	Most less than 10 μm in length
Zircon	
Sn/Fe, Cu, S/	Amorphous to X-rays (?)

From: Mitchell and Gluskoter (197

Minerals observed in this study

I. *Low-temperature ash minerals*
- Bassanite, from dehydration of gypsum
- Calcite
- Coquimbite, from decomposition of pyrite
- Dolomite
- Illite
- Kaolinite
- Pyrite
- Quartz
- Sphalerite

II. *High-temperature ash minerals*
- Anhydrite, from dehydration of bassanite, and from reactions between pyrite and calcite
- Anorthite, from reactions between calcite and/or bassanite and kaolinite
- Calcium iron oxide, CaO.FeO, from initial calcite and pyrite
- Clinopyroxene, from reactions between dolomite (and calcite + pyrite) and kaolinite
- Corundum, from initial kaolinite
- Cristobalite, from initial kaolinite
- Ferric sulphate, $Fe_2(SO_4)_3$, from the dehydration of coquimbite
- Gehlenite, from reactions between bassanite and kaolinite
- Hematite, from pyrite
- Lime, from calcite
- Magnetite, from initial pyrite
- Metakaolinite, from kaolinite (lower temperatures)
- Mullite, from kaolinite (higher temperatures)

> "The scanning electron microscope equipped with an energy dispersive xray detector is a nearly ideal tool for the purpose of studying the minerals in coal".

Nevertheless, the limitations to SEM-EDX were also cited:

1. Manual SEM-EDX systems analyse individual particles rather than bulk samples. Characterizing a single coal is very time intensive.
2. Computer controlled SEM-EDX Image Analysis systems can analyse thousands of particles but ignore the mineral-maceral textures.
3. Low atomic number elements are overlooked by EDX (F,O,C, B, Be, Li).

3.o.ii) Sample Preparation

A representative sample was mounted as a 25cm diameter leucite pellet using a Metaserv moulding unit in the same manner as for petrographic analyses. Pellets were polished on three Metaserv polisher-grinders using graded polishing powder following standard petrographic procedures (Section 3.n.ii). Pellets were analysed from the original bulk sample as well as float-sink fractions and low temperature ashes. To prevent beam charging, pellets were coated with an atomic layer of carbon using a fiber filament in a Polaron SEM coating system. Aluminum tape was used to make electroconductive connections with the sample holder.

As Staton and Finkelman (1979) point out, polished pellets of coal fragments are the easiest to prepare. Macerals and minerals can be identified by a combination of optical and SEM imaging. Such pellets, however, have the following drawbacks:

1. Secondary electron imaging is poor because of low relief. Backscattered electron imaging (BEI) is, therefore, preferred to enhanced atomic number differences but at a loss in magnification (limited to < x 5000).
2. Some minerals will be lost by "plucking" during polishing.
3. Contamination from polishing agents is expected. Huggins et al. (1980) reported up to 20% of particulates attributable to Al_2O_3 and Cr_2O_3 polish.
4. High atomic number elements are overemphasized. Huggins et al., (1980) report that a 0.75 correction factor should be applied to pyrite abundance estimates because of the high contrast in BEI.

Nevertheless, for this study the advantages provided by pellet mounts far overshadowed any shortcomings:

1. The flat surface allowed for electroconductive carbon coating instead of gold, thereby removing one interference to the EDX spectrum and yielding excellent BEI images.
2. The flat surface eliminated instrument artifact peaks on the EDX spectrum and yielded very reproducible mineral spectra even for submicron particles.

3. Internal mineral textures and mineral-maceral relationships were revealed in cross-section.
4. The backscatter electron image was very effective for locating minerals by image contrast.

The following will, therefore, concentrate on techniques applied to the carbon coated coal pellet mounts.

3.o. iii) Scanning Electron Microscopy (SEM) Operations

A JEOL T300 scanning electron microscope, operated at 20 Kv using a 20mm working distance and eucentric stage was used to analyse the carbon coated pellets. Photomicrographs were obtained at various magnifications from a 2000 line resolution CRT on 4" x 5" Polaroid PN55 film using 90 second exposures. Under optimum conditions, an image resolution of 6nm is possible.

Mineralogical information was obtained with an annular-type backscattered electron detector (BEI). At 20 Kev macerals and epoxy appear as low contrast background while minerals appear as bright grains. Relative brightness is a function of the atomic number of the elements present. Resolution in BEI is not as good as for SEI, but it is possible to discern minerals down to 0.1 micron in diameter.

The system is capable of detecting all elements from sodium (Z+11) to uranium (Z+92) in the Periodic Table.

Elements below Na are not detected because of the presence of a beryllium window protecting the Si(Li) detector. Therefore, the system can differentiate most minerals except for the following:

1. Isomers such as pyrite (FeS_2) and marcasite (FeS_2).
2. Minerals differing only in light elements H, Li, Be, B, C, N, O, and F.
3. Hydrated species ($CaSO_4$ versus $CaSO_4,2H_2O$)

Mineral identifications were based on the major element spectral characteristics identified by Walton (1984) and Huggins et al. (1980), (repeated in Hamburg, 1984). Certain assumptions had to be made based on this published experience. Kaolinite and illite were assumed to be the major clays, rather than their spectral isomers: halloysite and muscovite. Likewise "pyrite" was preferred over "marcasite" unless morphological evidence existed for sectored or radial crystals. "Siderite" was preferred over "magnetite or hematite" even though the EDX couldn't differentiate oxides from carbonates. These assumptions are, however, supported by extensive petrographic evidence of Sprunk and O'Donnell (1942) regarding mineral abundances.

3.o.iv) Energy Dispersive Xray (EDX) Microanalysis

The major element chemistry of small particle areas was obtained through a Tracor Northern TN5500 microanalyser, coupled to the SEM. A horizontal Si(Li) crystal was used as detector, with a 30mm^2 surface area, giving a 154 ev resolution. Voltage pulses from the detector are digitized by an analog-to-digital converter (ADC) based on peak heights. A histogram of intensity versus amplitude is formed by storing these pulses as sequential ADC channels (up to 4096). Data processing was by DEC LSI 11/23 minicomputer with 256K byte CPU, twin disk drives, high resolution colour monitor and dot matrix printer.

Representative EDX spectra were collected manually in spot mode for 50 seconds at 20Kev excitation. Final EDX peak spectra were routinely collected over the 0 to 10 Kev range. If heavy elements were indicated, diagnostic peaks beyond 10Kev were monitored.

3.o.v. Automated Image Analysis (AIA)

Automated SEM-EDX-image analysis was performed using backscatter electron imaging and EDX as described. Methods were modified from those of Huggins et al (1982), using software and hardware modules from Tracor Northern Inc. (Madison, Wisconsin).

Digital beam control was implemented through hardware modules, TN-1310 and Microscan and run parameters were selected by the operator and stored to disk. The SEM beam was stepped over the field of view in regular spacings. A large grid-point spacing (off-point) was used to locate particles with denser spacings (on-point) used to measure particles. Particle recognition was based on lower and upper thresholds of the digitized video signal (BEI).

Once detected, particles are measured for dimensions and shape, based on eight diagonals traced by the beam. The particle center is used to locate the beam for subsequent Xray acquisition. The dimensional data include average, minimum and maximum diameters, perimeter, area and position. Xray data yield relative proportions of elements and xray counts, used to classify the particles by chemical type.

For each particle, a "shape factor", based on area and perimeter is calculated, and used to control the recognition of grains:

$$\text{shape factor} = \frac{(\text{perimeter})^2}{\text{area} \times 4\,\text{pi}}$$

example:
= 1.0 for sphere
= 1.27 for square
= 3.85 if aspect ratio is 10:1
= 7.0 if aspect ratio is 20:1

Two software programmes are used, written in Flextran, and designed for simple, non-overlapped, low-aspect ratio particles:

1. Particle Recognition and Characterization (PRC): program for data acquisition.
2. Particulate Reanalysis Program (PRP): for editing and file merging.

Average particle sizes are displayed as histograms for each chemical type (i.e. "mineral"). Up to 25 elements are monitored for the definition of up to 61 chemical types. The parameters of operation and the chemical classes were developed at the Atlantic Coal Institute and substantially modified from those of Huggins et. al., (1982) and Hamburg (1984).

For this project, a magnification of 50X was selected covering particles of 5 to 75 microns with 1 - 7 shape factors. Off-point spacing was defined by the minimum particle size class with on-point spacing at 10%. The lower threshold was set on a BEI signal slightly above coal background, with the upper threshold at maximum. Xray acquisition was from 20 Kev excitation, for 2 seconds per particle with no ZAF corrections. Results can be found in Appendix II.

4. RESULTS AND DISCUSSION

4.a. Effects of Sample Storage

The samples analysed in this study were collected in 1984 and stored under nitrogen. In order to determine the possible weathering or oxidation effects, a number of duplicate analyses were completed in 1985-1986 on separate splits from the bulk samples. Tables 66 and 67, Appendix I.D. contain results from float-sink analyses on Prince/Hub, -42m to +100m. Ash values compare well on the heavier specific gravity fractions but not very well on the lighter specific gravity fractions. This suggests that the most recent float-sink analysis was not as efficient at separating the mineral matter fraction from the coaly fraction. Sulphur values are slightly higher while calorific value results are slightly lower in the more recent float-sink fractions. This may be explained in part by the efficiency of the separation (more ash in a fraction resulting in higher sulphur content and lower Btu's), but oxidation may also have an effect on these results.

Tables 69 and 70, Appendix I.D. contain results from the elemental analyses on the same float-sink fractions. Hydrogen is slightly lower and oxygen is slightly higher in the most recent fractions suggesting a loss of hydrogen through time.

Tables 71 and 73, Appendix I.D. compare plastometry results for each sample over time. There is a marked decrease in maximum fluidity in both samples with a slight variable increase in other measurable parameters such as: initial softening temperature, temperature of maximum fluidity, and solidification temperature. Thus, as expected, the reactive nature of the coal has been reduced through time.

Tables 72 and 74, Appendix I.D. compare dilatometry results for each sample. There is a marked increase in maximum contraction for both samples over time. The maximum expansion value increased for the Minto/Chipman #2 sample while no expansion was observed for the Prince/Hub sample in 1984 and 1986. This suggests that the softening ability of the coals has increased with time. The Prince/Hub coal exhibits poor coking qualities, while the Minto/Chipman #2 exhibits moderate coking qualities and would need to be blended with coals of good quality. The dilatometer was repaired in 1985 after the original set of data was generated, which could also account for discrepencies.

Evidence does suggest that both chemical and physical changes have occurred with storage of these coals over the past two years. These changes, however, should not have a major effect on the mineralogy within the coals and the association of minerals with organic fractions or macerals for which this study is concerned.

4.b. Maceral Concentrates

It was initially proposed to follow the work of Dyrkacz and Howitz (1982) for maceral separations using density gradient centrifugation (DGC). As outlined in our progress report, February 28, 1986, Parkash *et al* (1985) identified the experience that the Alberta Research Council has had with this procedure. Both laboratories have discontinued the procedure for the following reasons:

1. Comminution

For density gradient centrifugation, a narrow particle size of approximately 3 microns is required which Dyrkacz and Horwitz (1982) achieve by ball milling and a fluid energy mill. This, however, leads to problems with petrographic recognition of macerals. Optical microscopic magnifications of 1250x are needed, compared to standard reflectance microscopy at 500x. Even then, some 40% of material cannot be identified.

2. Corrosion

Dyrkacz and Horwitz (1982) recommend CsCl solution (cesium chloride) for DGC rather than the more classic $ZnCl_2$ for sink-float. The experience at the Alberta Research Council has been that the very corrosive nature of CsCl leads to equipment damage and leakages.

3. Sample Size

Both Parkash et.al., (1985) and Drykacz et.al., (1984) have recently commented on the limitations of DGC due to small sample recoveries, leading these investigators to resorting to hand-picked macerals at the expense of purity.

A further limitation was encountered in attempts to acquire the necessary hardware for the DGC technique.

A literature survey was conducted in order to identify more appropriate procedures of maceral separation. Winans and Crelling (1984) provide a brief review of recent maceral separation techniques, but reference to separations for bituminous coal dates back to Findley and Wigginton (1922) and earlier. Van Krevelin (1961) gave a flow-chart for centrifugation procedures using $ZnCl_2$ with the following recoveries (p.113):

exinite 1.25 float
vitrinite 1.35 float
micrinite 1.45 float
fusinite; minerals 1.45 sink

Kinghorn and Rahman (1980) utilized a modification of palynology separation procedures to isolate kerogen types, using $ZnBr_2$ solutions (diluted with HCl and high speed centrifugation). A number of experiments on the -1/2" bulk sample pulverized to -325 mesh (-45 um) were conducted in the laboratory using both $ZnCl_2$ and $ZnBr_2$ heavy media with the specific gravity fractions used by Van Krevelen. Experiments were also completed on mineralized versus demineralized fractions and better recoveries were obtained on demineralized fractions. Thus the final results of maceral separations were completed on "demineralized" fractions and do not reflect the total mineralogy of the coals studied. Maceral composition of the 1.35 float-sink fractions using both $ZnBr_2$ and $ZnCl_2$ were examined using the reflected light petrographic microscope and results can be found in Table 26 Appendix I.A. From these experiments, it was decided to complete further work using the $ZnBr_2$ float-sink fractions due to slightly higher maceral concentration recoveries in each specific gravity fraction. Maceral compositions of the float-sink fractions for both the Prince/Hub and Minto/ Chipman #2 can be found in Tables 27 and 28, Appendix I.A., using $ZnBr_2$. These tables show a distinct concentration of maceral types according to specific gravity. The inert category (1.45 float), however, does appear to be diluted with the vitrinite category (1.35 float). This is probably due to the intimate nature of these macerals. Vitrinite forms the matrix or groundmass for other macerals and finer grinding would be necessary to improve the separations. Table 29 illustrates maceral separation results from published literature, while table 30 contains results from this study on a comparable mineral matter free basis. Parkash _et_. _al_., obtained similar results concentrating the exinite and vitrinite fractions but were more successful with the inert fraction using the DGC technique. He used a size fraction of -3um which accounts for the greater concentration of inerts.

Results from Rock-Eval and elemental analysis can also be found on these maceral separations in Appendix I.A.

A second attempt to concentrate macerals was made by hand-picking the samples into three categories:

1. bright fraction
2. bright-banded fraction
3. dull banded fraction

Rock-Eval, elemental analysis and petrographic analyses were completed on each fraction and can be found in Tables 31 to 40 Appendix I.B. This manual picking method resulted in as good or better concentrations of the vitrinite category (1.35 floats) in the bright fraction. The bright-band fraction, however, does not concentrate the exinite category (1.25 floats) to any great extent. The dull banded fraction on the otherhand, is more successful than the 1.45 floats were at concentrating the inert category. This suggests that hygrading by hand- picking the fractions, followed by demineralization and a complete float-sink analysis using the specific gravities outlined by van Krevelen (1961) should result in reasonably good concentrations of macerals.

4.c. Maceral-Mineral Associations

4.c.i) Optical Microscopy

The reflected light microscope has been utilized for many years to characterize the organic portion of coal - the macerals. It can also be used to distinguish major mineral groups such as pyrites, clays, quartz and carbonates, although identification is limited to the resolution of the light microscope.

Both Prince/Hub and Minto/Chipman #2 can be classed as high volatile A bituminous coals based on a mean maximum vitrinite reflectance value of 0.77% and 0.83% respectively. Table 6 and Figures 5 and 6, Appendix I.A., contain raw data and histogram plots of reflectance values for these coals. The two coals differ slightly in their maceral composition as can be seen from Tables 4 and 5, Appendix I.A. Prince/Hub contains more vitrinite while Minto/Chipman #2 is higher in semiinert macerals and slightly higher in mineral matter.

Pyrite was abundant in both seams studied, most commonly observed embedded in vitrinite, although it was also observed in association with other macerals such as fusinite and exinite. This intimate association with coaly matter suggests formation of pyrite early in the depositional history of the coal when compaction was still minor and water circulation was unrestricted. Stringers or lenses of pyrite were also formed in the early stages of diagenesis and their elongation direction parallels the bedding plane. The larger irregular patches often observed are probably secondary in nature and formed after coalification as cleat and fracture fillings. Sample crushing for pellet preparation would destroy evidence of this and leave behind irregular shaped pyrite pieces.

Pyrite was rather coarsely distributed throughout the coal particles in the Prince/Hub sample, with the majority of grains greater than 20um in size. The pyrite crystals were rather "immature" with little evidence of well developed crystal faces. Globules were very common and closed framboids approaching globular form were observed.

Pyrite in the Minto/Chipman #2 sample appeared quite differently when compared to the Hub sample. Here pyrite was also coarsely distributed throughout the coal, but the crystal form was developed to a much greater extent and would be considered "mature". Framboids were abundant and exhibited well formed enhedral crystals. Solitary crystals and crystal clusters were also common.

Other minenerals such as quartz and clays were noted using the optical microscope although characterizing their occurrence is much more practical using the scanning electron microscope with energy dispersive xray capabilities.

4.c.ii) Scanning Electron Microscopy

a) Bulk Coal

A manual "mineral analysis" (operator selected a representative field of view and analysed individual grains) as well as a Particle Recognition and Characterization (PRC) analysis was completed on the bulk split of each coal. Results from the manual analysis can be found in Plates 1 and 2, Appendix II, with corresponding EDX spectra, while Plate 9 contains areas analysed by the PRC program along with results and histograms of mineral distributions. Tables 4 and 5 contain a summary of minerals observed in the SEM-EDX analysis.

The Prince/Hub sample contains massive pyrite which is probably epigenetic cleat and fracture fillings dislodged by sample preparation. Finely dispersed pyrite crystals and globules lie parallel to weak bedding planes. These crystals predate the cleat filling, having grown syngenetic with peat formation. Some grains in this sample are mineral depleted while other grains are highly mineralized indicating environmental and despositional changes throughout the history of coalification.

Both illite and kaolinite are present along with detrital quartz grains. The automated PRC analysis indicated such minerals as zircon and chalcopyrite were present in

TABLE 4. Minerals Observed In SEM-EDX Analyses.

		SILICATES		CARBONATES			CLAYS				SULPHIDES						SULPHATES		PHOSPHATES		OTHERS		
SAMPLE I.D.	FRACTION	Qtz	Zir	Sid	Cal	Dol	Ill	Ill +Ti	Kao	Chl	Py	Py + As	Cpy	Gal	Sph	FeS?	Gyp	Bar	Apa	Mon	Rut	Hal	Cont
PRINCE/HUB	bulk	*	*				*	*	*		*		*			*							*
	handpicked:																						
	bright	*					*		*		*	*											*
	bright banded	*					*	*	*		*												*
	dull banded	*						*	*	*	*					*							*
	@-42m to +100m																						
	1.30 float	*	*				*	*	*		*		*			*					*		
	1.50 sink	*	*	*			*	*	*		*				*	*	*			*			
	1.80 sink	*	*	*			*	*	*	*	*					*	*						
	LTA 1.30 float																						
	original	*					*		*		*												
	2.00 float	no sample																					
	2.85 float	*			*			*	*		*												
	2.85 sink	no sample																					
	LTA 1.50 sink																						
	original	*						*	*		*					*							
	2.00 float	no sample																					
	2.85 float	*				*		*	*		*												
	2.85 sink	*					*		*		*								*				
	LTA 1.80 sink																						
	original	*					*		*		*										*		
	2.00 float	no sample																					
	2.85 float			*			*		*		*					*							
	2.85 sink	*					*		*		*					*					*		

@ mineral identification based on PRC program

Qtz	Quartz	Ill	Illite	Gal	Galena	Mon	Monazite
Zir	Zircon	Kao	Kaolinite	Sph	Sphalerite	Rut	Rutile
Sid	Siderite	Chl	Chlorite	Gyp	Gypsum	Hal	Halite
Cal	Calcite	Py	Pyrite	Bar	Barite	Cont	Contaminant
Dol	Dolomite	Cpy	Chalcopyrite	Apa	Apatite		

TABLE 5. Minerals Observed In SEM-EDX Analyses.

		SILICATES		CARBONATES			CLAYS				SULPHIDES						SULPHATES		PHOSPHATES		OTHERS		
SAMPLE I.D.	FRACTION	Qtz	Zir	Sid	Cal	Ank	Ill	Ill +Ti	Kao	Chl	Py	Py + As	Cpy	Gal	Sph	FeS?	Gyp	Bar	Apa	Mon	Rut	Hal	Cont
MINTO/CHIPMAN 2	bulk	*	*	*	*		*	*	*		*					*					*		*
	handpicked:																						
	bright	*					*	*		*	*	*							*				*
	bright banded	*					*	*	*		*												*
	dull banded	*						*	*	*	*	*							*		*		*
	@-42m to +100m																						
	1.30 float	*	*				*	*	*		*		*			*			*		*		
	1.50 sink	*		*			*	*	*	*	*					*			*	*			
	1.80 sink	*	*	*	*		*	*	*		*					*	*		*				
	LTA 1.30 float																						
	original	*		*			*		*		*					*					*		
	2.00 float	*					*	*			*												
	2.85 float	*						*	*		*												
	2.85 sink	*					*				*												
	LTA 1.50 sink																						
	original	*					*		*		*								*				
	2.00 float	no sample																					
	2.85 float	*					*		*		*												
	2.85 sink							*	*		*										*		
	LTA 1.80 sink																						
	original	*					*	*	*	*	*												
	2.00 float	*					*		*		*										*		
	2.85 float	*			*			*	*		*								*		*		
	2.85 sink	*			*			*	*		*					*							

@ mineral identification based on PRC program

Qtz Quartz
Zir Zircon
Sid Siderite
Cal Calcite
Dol Dolomite

Ill Illite
Kao Kaolinite
Chl Chlorite
Py Pyrite
Cpy Chalcopyrite

Gal Galena
Sph Sphalerite
Gyp Gypsum
Bar Barite
Apa Apatite

Mon Monazite
Rut Rutile
Hal Halite
Cont Contaminant

trace amounts. The coaly matrix contains the following elements: S; Fe; Cl; Si; Al (±K, Ti, Ca).

The Minto/Chipman #2 also contains massive pyrite and an abundance of crystalline pyrite intimately associated with coal. Evidence of roof rock or clay parting is illustrated in Plate 2, Photo 2. The dark stringers running through this illite grain is organic in nature suggesting close association of organic and inorganic accumulations. The bright crystals embedded in the clay are predominantly pyrite.

Most grains in this sample are mineralized to some degree with syngenetic pyrite. Detrital quartz grains as well as kaolinite and illite are also common. Rutile was noted in the manual analysis as well as the automated PRC analysis. PRC also recognized such minerals as siderite, calcite and zircon in trace amounts. The coaly matrix of Minto/Chipman #2 contains the following elements: Si; Al; Fe (±K, Ti, Ca). Note the distinctive lack of chlorine when compared to the EDX matrix spectra collected from the Hub sample. Chlorine in the organic fraction of the Hub coal suggests that this seam may have had a greater marine influence.

b) Hand-Picked Fractions

Manual "mineral analyses" were completed on the hand-picked bright, bright banded and dull banded coals for each sample and results can be found in Plates 3 to 8, Appendix II.

Generally, the bright fraction was deficient in mineral matter while the bright banded fraction contained an abundance of minerals, especially pyrite. These minerals often exhibited lineation with other minerals, parallel to bedding. The dull banded fractions appeared to be rich in clays such as illite and kaolinite, often observed as cell fillings in fusinite. Pyrite was also common in the dull fraction. This suggests that the megascopic lithotypes of the coal not only reflect the maceral composition, but may also give an indication of the mineral composition.

c) Float-Sink Fractions

The Particle Recognition and Characterization program (PRC) was run on three float-sink fractions from the -42 mesh to +100 mesh sieve fraction, and Plate 10 contains results and histograms from both samples.

As can be seen from photographs 1 through 8, there is a distinct concentration of mineral matter as the specific gravity fraction increases from 1.30f to 1.50s to 1.80s. The Hub sample tends to be enriched in clays in the heavier float-sink fraction (P#6), while the Chipman #2 sample is rich in pyrite (P#8). Other minerals observed can be found in Tables 4 and 5.

d) Low Temperature Ash (LTA) - Mineral Separations

An attempt was made to concentrate the heavy minerals in the samples by low temperature ashing each of the float-sink fractions, namely: 1.30 float, 1.50 sink and 1.80 sink. Each of the low temperature ashes was then separated into the following fractions: 2.00 float, 2.85 float, and 2.85 sink. Results from the LTA's can be found in Plates 11 to 16, Appendix II. The 2.00 floats contained most of the coaly fraction that remained in the sample due to incomplete ashing along with the "fluff" or by-product often created by ashing at low temperatures.

For most samples, there was very little or no 2.00 float fraction, suggesting that relatively complete ashing was obtained, although coaly matter was visible in other fractions, intimately associated with the mineral matter.

For most fractions, the 2.85 float represented a concentration of clays, both illite and kaolinite, along with quartz. Pyrite was present although not dominant. Often the clays formed discrete lineations or banding, following bedding planes or were observed as cell fillings in fusinite. Plate 13, Photo 3, illustrates a close up of typical "bogen" structure in fusininte with interstitial areas filled with kaolinite.

The 2.85 sink fraction exhibited a concentration of pyrite although clays were also present. Minerals such as zircons and monazites were not detected, although attempts were made to locate them. This would suggest that although these minerals may be present in the coals, they are rare and even by concentrating a heavy mineral fraction by low temperature ashing followed by float-sink, these minerals are difficult to locate.

A careful examination of some of the EDX spectra for LTA fractions indicates that a chemical change has occurred in some minerals through the low temperature ashing process. Often there are changes in expected elemental ratios for minerals, the most notable of which being pyrite. Sulphur appears to be lost and the ratio approaches in many cases Fe: S, similar to the mineral pyrrhotite. Deposits of yellow crystallization inside the low temperature ashing chamber support this loss of sulphur even at low temperatures. Some spectra appear as a mixture of minerals such as pyrite and clays. This can probably be related to the surface relief of the LTA pellets. Although great care is taken to provide a fine polished surface for viewing LTA's, plucking of the mineralization often occurs.

APPENDIX I

A. DATA TABLES ON BULK ANALYSES

TABLE 1.

SIEVE ANALYSIS
SAMPLE : PRINCE/HUB Homer City Subsample

SCREEN SIZE	PERCENT RETAINED	CUMULATIVE % RETAINED	% ASH (as) (determined)	% SULPHUR (as) (determined)	CALORIFIC VALUE BTU/lb* (as determine
+2"	**	**	**	**	**
+1 1/4"	4.66	4.66	20.95	4.49	10421
+1"	3.77	8.43	24.21	4.85	10323
+1/2"	15.72	24.15	21.57	7.05	10682
+1/4"	19.82	43.97	24.22	4.41	10574
+1/8"	17.08	61.05	20.07	3.96	11081
+28 MESH	25.56	86.61	23.63	4.11	10191
+100 MESH	8.41	95.02	28.80	4.29	9152
+200 MESH	1.96	96.98	30.16	5.41	9029
-200 MESH	3.02	100.00	34.24	5.22	8396

TABLE 2.

SIEVE ANALYSIS
SAMPLE: MINTO / CHIPMAN 2

SCREEN SIZE	PERCENT RETAINED	CUMULATIVE % RETAINED	ASH % (as) (determined)	SULPHUR % (as) (determined)	CALORIFIC VALUE BTU/lb* (as determined)
+2"	**	**	**	**	**
+1 1/4"	12.26	12.26	34.35	7.66	12139
+1"	8.51	20.77	26.37	14.40	10551
+1/2"	24.26	45.03	22.50	11.20	10587
+1/4"	18.80	63.83	27.08	10.90	11208
+1/8"	12.46	76.29	24.57	10.30	10917
+28 MESH	15.89	92.18	26.93	9.68	10344
+100 MESH	4.41	96.59	30.52	9.68	9498
+200 MESH	1.26	97.85	36.81	10.60	8543
-200 MESH	2.15	100.00	44.00	12.30	7125

* sulphur corrected
** no sample

TABLE 3 -1/2" bulk subsample – ASTM tests

Analysis		PRINCE/HUB HC	MINTO/CHIPMAN 2
PROXIMATE	Moisture %	3.54	1.12
	Volatiles %	30.18	31.10
	Ash %	25.46	23.98
	Fixed Carbon %	44.36	44.92
ULTIMATE as det.	Carbon	57.16	55.68
	Hydrogen	3.88	3.58
	Nitrogen	0.88	0.64
	Oxygen	8.50	5.78
	Sulphur	4.46	10.85
dry	Carbon	59.26	56.31
	Hydrogen	4.02	3.62
	Nitrogen	0.91	0.65
	Oxygen	8.81	5.85
	Sulphur	4.62	10.97
dry, ash free	Carbon	80.51	74.34
	Hydrogen	5.46	4.78
	Nitrogen	1.24	0.85
	Oxygen	11.97	7.72
	Sulphur	6.28	14.49
PLASTOMETRY C	Starting T	330	330
	Initial Soft. T	386	357
	Max Fluid T	431	422
	Solidification T	446	463
	Max Fluidity ddpm	13.8	31791.0
DILATOMETRY C	Softening T	383	353
	Max Dilatation T	---	431
	Max Contraction %	14% @ 470	16
	Max Dilatation %	---	14
	G Factor	---	0.993

TABLE 4.

MACERAL ANALYSIS: Prince/Hub - Homer City; bulk analysis Ro =0.77%

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	71.2	71.2	85.3
	EXINITE	SPORINITE	6.4	12.8	
		CUTINITE	0.0		
		RESINITE	6.4		
	SEMI-FUSINITE	REACTIVE SEMIFUSINITE	1.3	1.3	
INERT	SEMI-FUSINITE	INERT SEMIFUSINITE	2.7	2.7	14.7
	INERTINITE	FUSINITE	2.2	4.0	
		MACRINITE	0.4		
		MICRINITE	1.2		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.2		
	MINERAL MATTER	PYRITE	6.6	8.0	
		QUARTZ	0.2		
		CLAYS	1.2		
		CARBONATE	0.0		

TABLE 5.

MACERAL ANALYSIS: Minto/Chipman 2; bulk analysis Ro max = 0.83%

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	56.0	56.0	76.4
	EXINITE	SPORINITE	3.0	16.4	
		CUTINITE	0.8		
		RESINITE	12.6		
	SEMI-FUSINITE	REACTIVE SEMIFUSINITE	4.0	4.0	
INERT	SEMI-FUSINITE	INERT SEMIFUSINITE	8.0	8.0	23.6
	INERTINITE	FUSINITE	1.0	4.2	
		MACRINITE	0.2		
		MICRINITE	1.8		
		SCLEROTINITE	0.4		
		INERTODETRINITE	0.8		
	MINERAL MATTER	PYRITE	8.6	11.4	
		QUARTZ	1.6		
		CLAYS	1.2		
		CARBONATES	0.0		

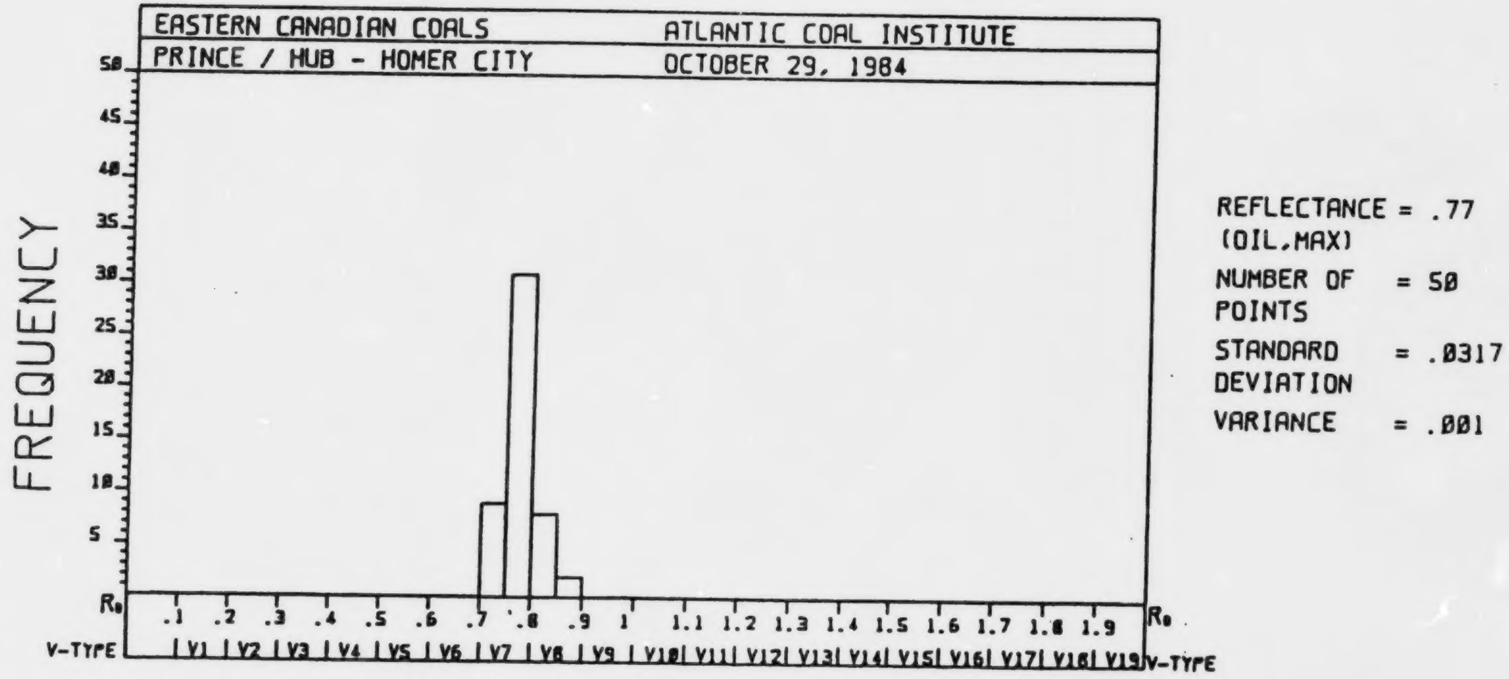


Figure 5. Reflectance histogram, Prince / Hub- Homer City

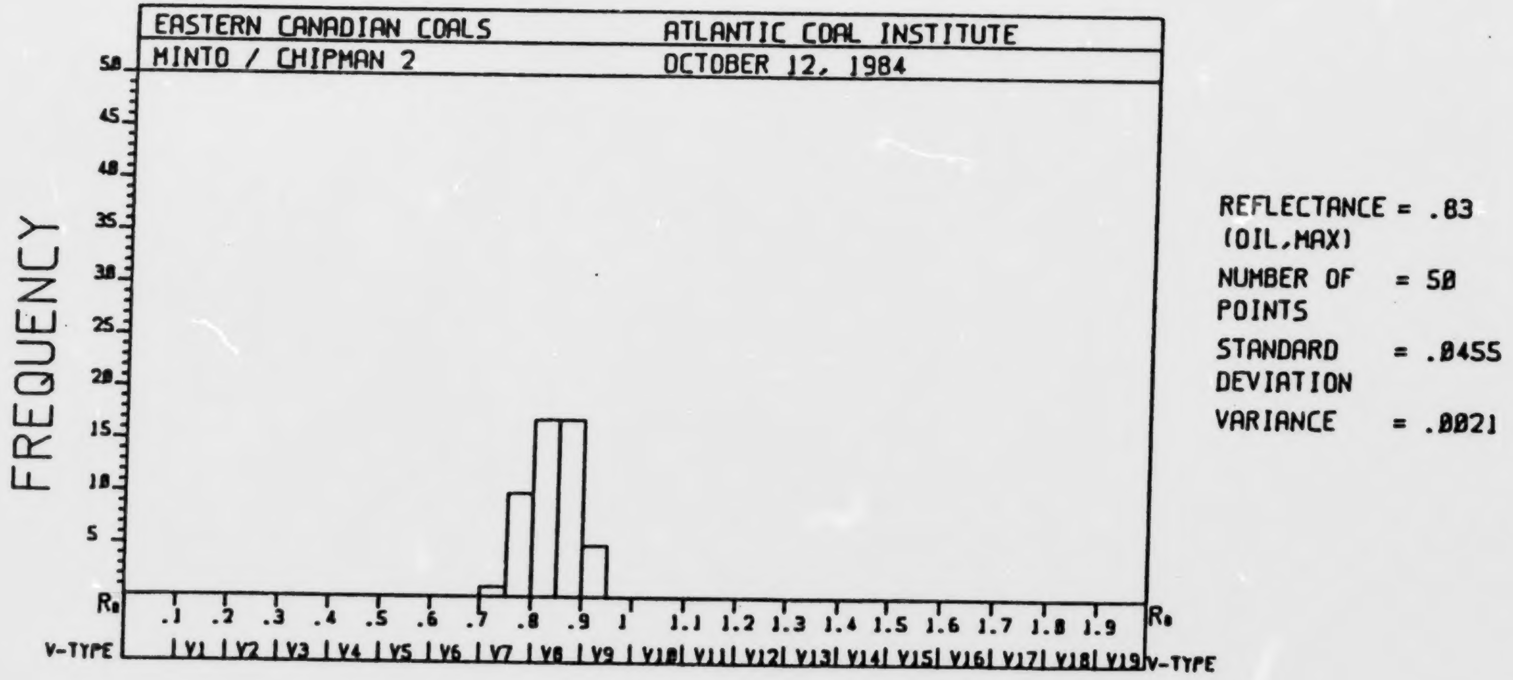


Figure 6. Reflectance histogram - Minto/ Chipman 2

TABLE 6.

VITRINITE REFLECTANCE DATA POINTS FOR EASTERN CANADIAN COALS

PRINCE / HUB - HOMER CITY

.86 .85 .82 .81 .81 .8 .8 .8 .8 .8 .79 .79 .79 .79 .78 .78 .78
.78 .78 .78 .78 .77 .77 .77 .77 .77 .77 .77 .77 .76 .76 .76 .76
.76 .76 .76 .76 .75 .75 .75 .75 .74 .73 .73 .73 .73 .72 .72 .71
.7

MINTO / CHIPMAN 2

.91 .91 .9 .9 .9 .89 .89 .89 .88 .88 .87 .87 .87 .87 .87 .86
.86 .86 .86 .85 .85 .85 .84 .84 .84 .83 .83 .83 .83 .83 .82 .82
.82 .81 .81 .81 .81 .8 .8 .79 .79 .79 .78 .78 .78 .76 .75 .75
.75 .74

TABLE 7

DEMINERALIZATION
-1/2" SUBSAMPLE

SAMPLE I.D.	% RECOVERY
MINTO/CHIPMAN (1)	79.10
MINTO/CHIPMAN (2)	79.80
PRINCE/HUB H.C.	66.39

TABLE 8.

-1/2" SUBSAMPLES DEMINERALIZED

		PROXIMATE ANALYSIS		
SPECIFIC GRAVITY FRACTION	MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
		dried basis		
MINTO/CHIPMAN #2	0.71	35.01	13.68	50.61
MINTO/CHIPMAN #2	0.81	35.71	13.21	50.26
PRINCE/HUB H.C.	1.81	41.08	4.81	52.30

TABLE 9.

-1/2" SUBSAMPLE
DEMINERALIZED

	ELEMENTAL ANALYSIS		
SAMPLE I.D.	CARBON %	HYDROGEN %	NITROGEN %
MINTO/CHIPMAN #2 (1)	65.46	4.17	0.84
MINTO/CHIPMAN #2 (2)	67.68	4.36	0.87
PRINCE/HUB H.C.	71.82	4.41	1.25

TABLE 10.

MACERAL SEPARATIONS: ZINC CHLORIDE SOLUTIONS

COMPARISON OF MINERALIZED vs DEMINERALIZED SAMPLES

SAMPLE: MINTO/CHIPMAN #2 -1/2" SUBSAMPLE

RELATIVE SPECIFIC GRAVITY FRACTION	% RECOVERY	
	MINERALIZED	DEMINERALIZED
1.25 FLOAT (EXINITE RICH)	8.77	3.73
1.35 FLOAT (VITRINITE RICH)	31.58	45.96
1.45 FLOAT (MICRINITE RICH)	9.21	20.50
1.45 SINK (MINERAL RICH)	50.44	29.81
	100.00 %	100.00 %

TABLE 11.

MACERAL SEPARATIONS: ZINC BROMIDE / ZINC CHLORIDE SOLUTIONS

-1/2" SUBSAMPLE CRUSHED TO -325 MESH *

RELATIVE SPECIFIC GRAVITY FRACTION	PRINCE/HUB	
	ZINC BROMIDE	ZINC CHLORIDE
1.25 FLOAT (EXINITE RICH)	2.18	5.11
1.35 FLOAT (VITRINITE RICH)	46.72	38.64
1.45 FLOAT (MICRINITE RICH)	34.31	46.59
1.45 SINK (MINERAL RICH)	16.79	9.66
	100.00 %	100.00 %

RELATIVE SPECIFIC GRAVITY FRACTION	MINTO CHIPMAN #2	
	ZINC BROMIDE	ZINC CHLORIDE
1.25 FLOAT (EXINITE RICH)	0.94	3.73
1.35 FLOAT (VITRINITE RICH)	41.98	45.96
1.45 FLOAT (MICRINITE RICH)	28.30	20.50
1.45 SINK (MINERAL RICH)	28.78	29.81
	100.00 %	100.00 %

* Demineralized

FIGURE 7.

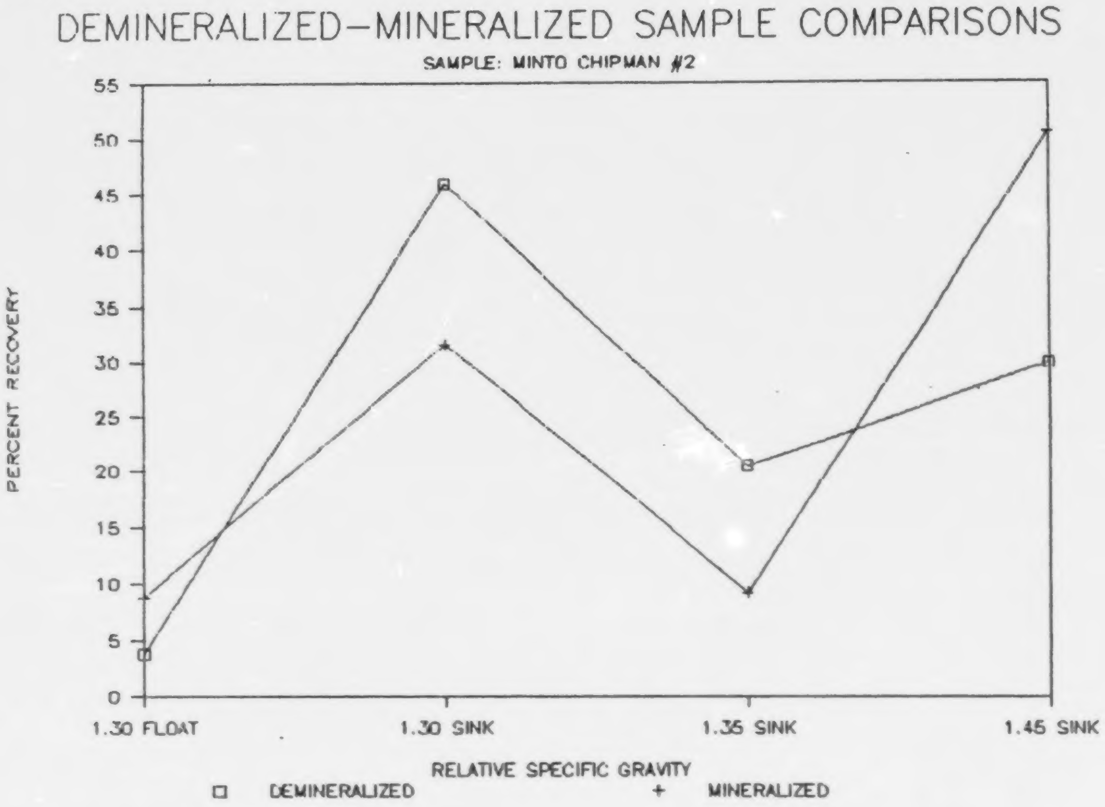


FIGURE 8.

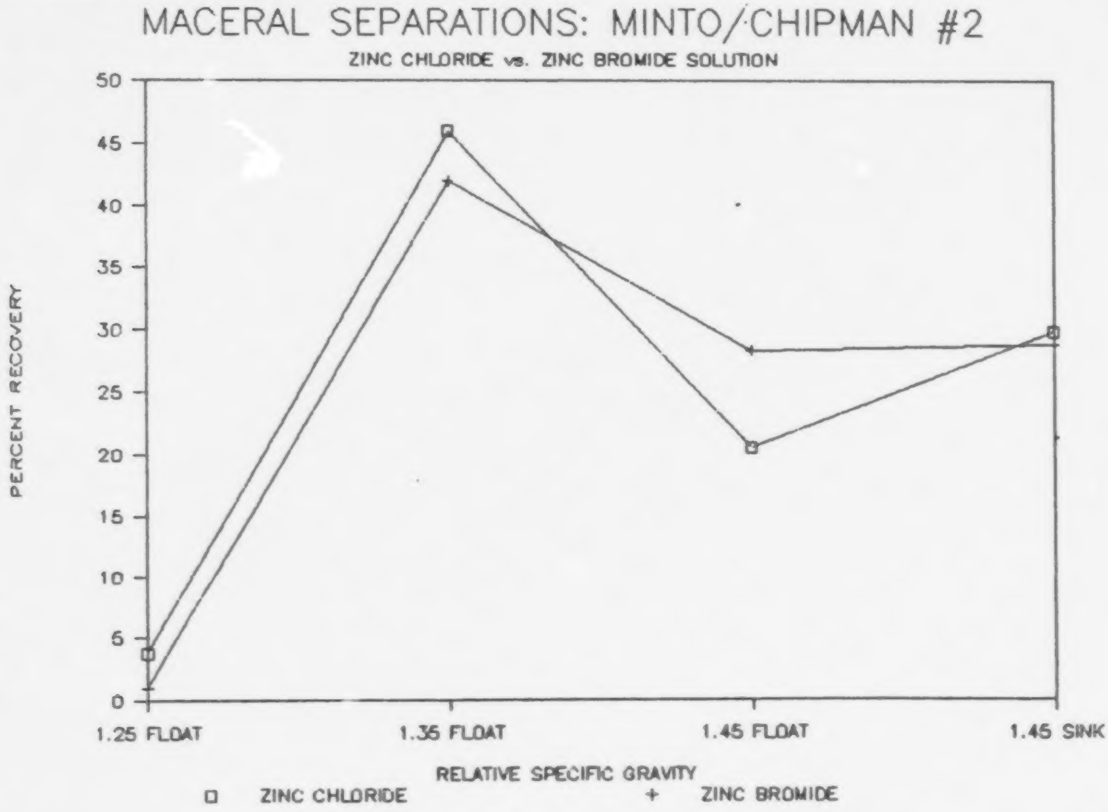


TABLE 12.

ATLANTIC COAL INSTITUTE
ROCK-EVAL ANALYSIS

	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	TOC (WT %)
ACI STD CERTIFIED :	0.00	1.37	15.02	442	4.62
ACI STD CHECKS :	0.00	1.24	14.83	449	4.47
	0.03	1.36	16.49	451	6.41
	0.00	1.31	16.19	443	4.85
	0.03	1.33	16.60	442	3.22
	0.00	1.28	15.42	441	4.43
	0.00	1.50	17.64	442	6.31

TABLE 13.

ACI-85-121-12 PRINCE/HUB H.C. -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
RUN #1	0.00	9.43	161.19	431	62.4	0.06	258

TABLE 14.

ACI-85-121-06 MINTO/CHIPMAN #2 -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
RUN #1	0.00	16.32	156.19	441	51.36	0.09	304
RUN #2	0.00	16.03	158.76	441	51.42	0.09	309

TABLE 15.

ZnCl2 SEPARATIONS
ACI-85-121-12 PRINCE/HUB H.C. -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT	0.00	6.87	159.72	425	70.27	0.04	227
1.35 FLOAT	0.00	6.43	152.18	433	55.91	0.04	272
1.45 FLOAT	0.00	7.10	114.67	430	56.48	0.06	203
1.45 SINK	0.00	4.16	90.83	432	48.37	0.04	188

TABLE 16.

ZnCl2 SEPARATIONS
ACI-85-121-06 MINTO/CHIPMAN #2 -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT	0.00	18.46	189.40	434	71.46	0.09	265
1.35 FLOAT	0.00	18.42	191.25	440	70.09	0.09	273
1.45 FLOAT	0.00	16.62	167.32	437	69.05	0.09	242
1.45 SINK	0.00	7.62	73.53	435	43.17	0.09	170

TABLE 17.

ZnBr2 SEPARATIONS
ACI-85-121-012 PRINCE/HUB H.C. -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT*	0.16	19.50	255.73	437	63.90	0.07	400
1.35 FLOAT	0.06	16.58	167.82	438	62.19	0.09	270
1.45 FLOAT	0.00	10.00	278.59	424	75.35	0.03	370
1.45 SINK	0.06	8.43	106.92	431	57.66	0.07	185

TABLE 18.

ZnBr2 SEPARATIONS
ACI-85-121-06 MINTO/CHIPMAN #2 -1/2" SUBSAMPLE DEMINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT*	0.00	23.84	293.17	420	69.43	0.08	422
1.35 FLOAT	0.19	20.64	186.49	449	61.51	0.10	303
1.45 FLOAT	0.06	21.28	153.01	449	50.45	0.12	303
1.45 SINK	0.06	10.98	94.93	445	50.45	0.10	188

* contaminated with filter paper

TABLE 19.

ZnCl2 SEPARATIONS
ACI-85-121-06 MINTO/CHIPMAN #2 -1/2" SUBSAMPLE MINERALIZED

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT	0.00	18.69	200.78	435	63.84	0.09	315
1.35 FLOAT	0.00	20.38	190.06	440	61.40	0.10	310
1.45 FLOAT	0.00	17.66	183.22	437	77.25	0.09	237
1.45 SINK	0.00	9.87	106.12	436	43.96	0.09	241

TABLE 20.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC CHLORIDE DEMINERALIZED SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS		
	CARBON %	HYDROGEN %	NITROGEN %
FLOAT-1.25	66.98	4.98	0.77
FLOAT-1.35	79.77	5.35	0.93
FLOAT-1.45	72.69	4.58	0.78
SINK-1.45	37.64	2.52	0.62

TABLE 21.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC CHLORIDE MINERALIZED SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS			
	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.25	79.70	5.43	0.92	6.40
FLOAT-1.35	78.22	5.13	0.89	6.38
FLOAT-1.45	71.24	4.59	0.78	6.84
*SINK-1.45	44.33	2.93	0.43	5.67
*SINK-1.45	43.92	2.94	0.41	

* SAMPLE RUN IN DUPLICATE FOR CHN

TABLE 22.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC CHLORIDE MINERALIZED SAMPLE SEPARATIONS

SPECIFIC GRAVITY FRACTION	PROXIMATE ANALYSIS			
	MOISTURE (%)	VOLATILES (%)	(%) ASH	(%) FIXED CARBON
		dried basis		
1.25 FLOAT	1.29	61.80	6.01	30.90
1.35 FLOAT	0.72	45.73	5.87	47.68
1.45 FLOAT	1.16	56.40	11.92	30.52
1.45 SINK	0.84	27.10	38.67	33.39

TABLE 23.

SAMPLE: ACI-84-121-012 PRINCE/HUB H.C.
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC CHLORIDE DEMINERALIZED SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS		
	CARBON %	HYDROGEN %	NITROGEN %
FLOAT-1.25	69.54	5.09	1.16
FLOAT-1.35	76.43	4.92	1.40
FLOAT-1.45	69.88	4.43	1.21
SINK-1.45	53.24	3.24	0.94

TABLE 24.

SAMPLE: ACI-84-121-012 PRINCE/HUB H.C.
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC BROMIDE DEMINERALIZED SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS		
	CARBON %	HYDROGEN %	NITROGEN %
FLOAT-1.25 *	73.45	5.69	1.16
FLOAT-1.35	77.20	5.04	1.38
FLOAT-1.45	55.61	3.84	0.93
SINK-1.45	60.05	3.61	1.03

TABLE 25.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -1/2" SUBSAMPLE
ZINC BROMIDE DEMINERALIZED SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS		
	CARBON %	HYDROGEN %	NITROGEN %
FLOAT-1.25 *	66.68	5.29	0.74
FLOAT-1.35	80.89	5.30	0.98
FLOAT-1.45	73.40	4.58	0.88
SINK-1.45	46.52	2.85	0.60

TABLE 26. MACERAL COMPOSITION* - 1.35 float Data Comparison.

	PRINCE / HUB		MINTO / CHIPMAN 2	
	ZnCl2	ZnBr2	ZnCl2	ZnBr2
VITRINITE	89.5	89.9	80.7	81.9
EXINITE	1.3	6.2	4.5	5.1
SEMI-INERTINITE	3.9	1.6	9.2	9.7
INERTINITE	3.5	1.6	3.4	1.8
PYRITE	1.8	0.7	2.2	1.5
CLAYS	0.0	0.0	0.0	0.0

* petrographic analysis completed on -1/2" subsample pulverized to -325m, after maceral seperation using ZnCl2 and ZnBr2.

TABLE 27 MACERAL COMPOSITION* - PRINCE / HUB.

S.G. fractions: GROUP MACERALS (vol %)	1.25 float n=24	1.35 float n=305	1.45 float n=377	1.45 sink n=228
VITRINITE	33.3	89.9	80.0	63.2
EXINITE	66.7	6.2	3.7	0.4
SEMI-INERTINITE	0.0	1.6	6.4	6.6
INERTINITE	0.0	1.6	6.1	5.7
PYRITE	0.0	0.7	1.9	11.8
CLAYS	0.0	0.0	1.9	12.3

TABLE 28 MACERAL COMPOSITION* - MINTO / CHIPMAM 2.

S.G. fractions: GROUP MACERALS (vol %)	1.25 float n=39	1.35 float n=392	1.45 float n=312	1.45 sink n=350
VITRINITE	43.5	81.9	62.8	48.5
EXINITE	51.3	5.1	2.9	1.7
SEMI-INERTINITE	2.6	9.7	15.1	9.4
INERTINITE	0.0	1.8	3.5	0.6
PYRITE	2.6	1.5	7.0	30.9
CLAYS	0.0	0.0	8.7	8.9

* petrographic analysis completed on -1/2" subsample pulverized to -325m, demineralized, followed by maceral seperation using $ZnBr_2$.

TABLE 29. MACERAL COMPOSITION - mineral matter free basis
Parkash et al., 1985, DGC Technique

SITE	S.G. fractions: GROUP MACERALS (vol %)	1.23-1.32	1.32-1.38	1.38-1.41
VESTA COAL	VITRINITE	30	92	22
	EXINITE	64	0	0
	SEMI-INERTINITE	2	3	32
	INERTINITE	3	5	56

TABLE 30. MACERAL COMPOSITION - mineral matter free basis
This Study

SITE	S.G. fractions: GROUP MACERALS (vol %)	1.25 float n=24	1.35 float n=305	1.45 float n=377	1.45 sink n=228
PRINCE/HUB	VITRINITE	33.3	90.6	83.2	83.3
	EXINITE	66.7	6.2	3.8	0.5
	SEMI-INERTINITE	0.0	1.6	6.7	8.7
	INERTINITE	0.0	1.6	6.3	7.5
MINTO/CHIPMAN2	VITRINITE	44.6	83.2	74.5	80.6
	EXINITE	52.7	5.2	3.4	2.8
	SEMI-INERTINITE	2.7	9.8	17.9	15.6
	INERTINITE	0.0	1.8	4.2	1.0

APPENDIX I

B. DATA TABLES ON HAND-PICKED FRACTIONS

TABLE 31

PICKED FRACTIONS (STEREOSCOPIC MICROSCOPE)

ACI-85-121-012 PRINCE/HUB H.C. BULK SAMPLE

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
BRIGHT	0.00	3.56	163.37	438	49.17	0.02	332
BRIGHT BANDED	0.00	4.18	165.33	440	62.66	0.02	264
DULL BANDED	0.00	1.73	86.93	437	49.77	0.02	175

TABLE 32

PICKED FRACTIONS (STEREOSCOPIC MICROSCOPE)

ACI-85-121-06 MINTO/CHIPMAN #2 BULK SAMPLE

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
BRIGHT	0.00	10.85	185.10	447	46.12	0.06	401
BRIGHT BANDED	0.00	14.52	184.86	447	51.58	0.07	358
DULL BANDED	0.00	10.90	141.31	447	59.19	0.07	239

TABLE 33.

SAMPLE: ACI-84-121-012 PRINCE/HUB H.C.
BULK SAMPLE
PICKED SEPARATIONS (STEREOSCOPIC MICROSCOPE)

HAND PICKED FRACTIONS	ELEMENTAL ANALYSIS CARBON %	HYDROGEN %	NITROGEN %
BRIGHT	75.26	5.08	1.29
BRIGHT-BANDED	78.45	5.18	1.34
DULL BANDED	45.74	3.16	0.59

TABLE 34.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
BULK SAMPLE
PICKED SEPARATIONS (STEREOSCOPIC MICROSCOPE)

HAND PICKED FRACTIONS	ELEMENTAL ANALYSIS CARBON %	HYDROGEN %	NITROGEN %
BRIGHT	NA	NA	NA
BRIGHT-BANDED	78.78	5.21	0.84
DULL BANDED	64.25	4.23	0.75

NA not available

TABLE 35.

MACERAL ANALYSIS: Prince/Hub; bulk split picked - bright fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	90.0	90.0	95.7
	EXINITE	SPORINITE	3.0	4.9	
		CUTINITE	0.0		
		RESINITE	1.9		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	0.8	0.8	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	1.6	1.6	4.3
	INERTINITE	FUSINITE	0.0	2.4	
		MACRINITE	0.3		
		MICRINITE	2.2		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	0.0	0.3	
		QUARTZ	0.0		
		CLAYS	0.3		
		CARBONATES	0.0		

TABLE 36.

MACERAL ANALYSIS: Prince/Hub; bulk split picked - bright banded fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	85.4	85.4	95.3
	EXINITE	SPORINITE	6.6	9.2	
		CUTINITE	0.6		
		RESINITE	2.0		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	0.7	0.7	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	1.3	1.3	4.7
	INERTINITE	FUSINITE	0.0	0.8	
		MACRINITE	0.0		
		MICRINITE	0.8		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	2.2	2.6	
		QUARTZ	0.0		
		CLAYS	0.4		
		CARBONATES	0.0		

TABLE 37.

MACERAL ANALYSIS: Prince/Hub; bulk split picked - dull banded fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	36.0	36.0	50.6
	EXINITE	SPORINITE	8.8	9.6	
		CUTINITE	0.0		
		RESINITE	0.8		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	5.0	5.0	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	10.0	10.0	49.4
	INERTINITE	FUSINITE	25.8	26.2	
		MACRINITE	0.0		
		MICRINITE	0.2		
		SCLEROTINITE	0.2		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	4.6	13.2	
		QUARTZ	0.4		
		CLAYS	8.2		
		CARBONATES	0.0		

TABLE 38.

MACERAL ANALYSIS: Minto/Chipman 2; bulk split picked - bright fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	88.0	88.0	95.4
	EXINITE	SPORINITE	1.9	6.5	
		CUTINITE	0.0		
		RESINITE	4.5		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	0.9	0.9	
	SEMI-INERTINITE	INERT SEMIINERTINITE	1.7	1.7	1.7
INERT	INERTINITE	FUSINITE	0.7	1.3	4.6
		MACRINITE	0.0		
		MICRINITE	0.7		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	1.3	1.6	
		QUARTZ	0.3		
		CLAYS	0.0		
		CARBONATES	0.0		

TABLE 39.

MACERAL ANALYSIS: Minto/Chipman 2; bulk split picked - bright banded fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	68.2	68.2	85.7
	EXINITE	SPORINITE	5.6	13.6	
		CUTINITE	0.6		
		RESINITE	7.4		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	3.9	3.9	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	7.9	7.9	14.3
	INERTINITE	FUSINITE	0.6	2.8	
		MACRINITE	0.0		
		MICRINITE	2.2		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	3.2	3.6	
		QUARTZ	0.0		
		CLAYS	0.4		
		CARBONATES	0.0		

TABLE 40.

MACERAL ANALYSIS: Minto/Chipman 2; bulk split picked - dull banded fraction.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	40.8	40.8	64.3
	EXINITE	SPORINITE	11.6	14.0	
		CUTINITE	0.0		
		RESINITE	2.4		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	9.5	9.5	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	19.1	19.1	35.7
	INERTINITE	FUSINITE	1.8	6.2	
		MACRINITE	1.4		
		MICRINITE	2.0		
		SCLEROTINITE	0.8		
		INERTODETRINITE	0.2		
	MINERAL MATTER	PYRITE	5.4	10.4	
		QUARTZ	1.6		
		CLAYS	3.4		
		CARBONATES	0.0		

APPENDIX I

C. DATA TABLES ON FLOAT-SINK FRACTIONS

TABLE 41.

SAMPLE: ACI-84-121-012 PRINCE/HUB HC ANALYZED 1984
SIZE FRACTION: -14 MESH TO +28 MESH

RELATIVE SPECIFIC-GRAVITY	ELEMENTARY DATA				CUMULATIVE DATA FLOAT				SINK			
FRACTIONS	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	45.31	2.21	3.04	14043	45.31	2.21	3.04	14043	100.00	22.86	4.72	10550
1.30-1.35	12.23	5.92	3.32	13411	57.54	3.00	3,10	13909	54.69	39.97	6.11	7656
1.35-1.40	5.57	9.32	4.60	12868	63.11	3.56	3.23	13817	42.46	49.77	6.91	5998
1.40-1.45	4.36	12.64	5.90	12254	67.47	4.14	3.40	13716	36.89	55.88	7.26	4961
1.45-1.50	2.56	16.02	7.34	11760	70.03	4.58	3.55	13644	32.53	61.68	7.44	3984
1.50-1.60	3.27	23.15	9.18	10524	73.30	5.41	3.80	13505	29.97	65.58	7.45	3319
1.60-1.70	2.03	26.60	9.70	9951	75.33	5.98	3.96	13409	26.70	70.77	7.24	2437
1.70-1.80	1.37	31.51	11.20	9070	76.70	6.43	4.09	13332	24.67	74.41	7.04	1819
1.80-2.00	1.72	39.30	10.71	7910	78.42	7.15	4.23	13213	23.30	76.93	6.79	1392
2.00-SINKS	21.58	79.93	6.48	873	100.00	22.86	4.72	10550	21.58	79.93	6.48	873

TABLE 42.

SAMPLE: ACI-84-121-012 PRINCE/HUB HC ANALYZED 1985
SIZE FRACTION: -42 MESH TO +100 MESH

RELATIVE SPECIFIC-GRAVITY	ELEMENTARY DATA				CUMULATIVE DATA FLOAT				SINK			
FRACTIONS	MASS %	ASH %	SULPHUR	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	31.94	3.90	1.77	13878	31.94	3.90	1.77	13878	100.00	28.95	4.29	9466
1.30-1.35	17.15	4.44	2.41	13597	49.09	4.09	1.99	13780	68.06	40.71	5.47	7396
1.35-1.40	4.29	8.49	3.87	12781	53.38	4.44	2.14	13700	50.91	52.92	6.51	5307
1.40-1.45	4.43	13.98	3.27	11160	57.81	5.17	2.23	13505	46.62	57.01	6.75	4619
1.45-1.50	2.34	14.26	5.51	11533	60.15	5.53	2.36	13428	42.19	61.53	7.11	3932
1.50-1.60	5.74	19.15	6.28	10803	65.89	6.71	2.70	13200	39.85	64.30	7.21	3486
1.60-1.70	2.08	26.30	7.89	9581	67.97	7.31	2.86	13089	34.11	71.90	7.36	2255
1.70-1.80	1.86	40.76	5.37	6978	69.83	8.20	2.93	12926	32.03	74.86	7.33	1779
1.80-2.00	3.69	43.65	9.04	6606	73.52	9.98	3.23	12609	30.17	76.97	7.45	1458
2.00-SINKS	26.48	81.61	7.23	741	100.00	28.95	4.29	9466	26.48	81.61	7.23	741

ACI-84-121-012 PRINCE/HUB HC
-100 MESH SIEVE FRACTION

ASH %	SULPHUR %	BTU/lb*
32.64	5.63	8898

TABLE 43.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2 ANALYZED 1986
SIZE FRACTION: -14 MESH TO +28 MESH

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTARY DATA				CUMULATIVE DATA							
					FLOAT				SINK			
	MASS %	ASH %	SULPHUR	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	14.36	2.80	2.42	14896	14.36	2.80	2.42	14896	100.00	20.69	8.28	11591
1.30-1.35	15.67	6.37	3.92	14291	30.03	4.66	3.20	14580	85.64	23.69	9.26	11037
1.35-1.40	11.83	9.60	5.57	13663	41.86	6.06	3.87	14321	69.97	27.57	10.46	10309
1.40-1.45	11.59	12.36	7.23	13071	53.45	7.42	4.60	14050	58.14	31.23	11.45	9626
1.45-1.50	7.66	15.90	8.29	12644	61.11	8.49	5.06	13874	46.55	35.93	12.50	8768
1.50-1.60	10.93	19.87	10.36	11668	72.04	10.21	5.87	13539	38.89	39.88	13.33	8005
1.60-1.70	3.54	24.82	11.66	10682	75.58	10.90	6.14	13405	27.96	47.70	14.49	6573
1.70-1.80	6.38	30.20	12.19	9629	81.96	12.40	6.61	13111	24.42	51.01	14.90	5977
1.80-2.00	2.90	35.63	13.64	8701	84.86	13.19	6.85	12961	18.04	58.37	15.86	4686
2.00-SINKS	15.14	62.73	16.29	3917	100.00	20.69	8.28	11591	15.14	62.73	16.29	3917

TABLE 44.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2 ANALYZED 1985
SIZE FRACTION: -42 MESH TO +100 MESH

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTARY DATA				CUMULATIVE DATA							
					FLOAT				SINK			
	MASS %	ASH %	SULPHUR	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	18.97	3.92	2.71	14256	18.97	3.92	2.71	14256	100.00	22.92	8.17	10651
1.30-1.35	17.74	6.52	3.06	13419	36.71	5.18	2.88	13852	81.03	27.37	9.44	9807
1.35-1.40	5.93	8.36	4.78	13232	42.64	5.62	3.14	13765	63.29	33.21	11.23	8795
1.40-1.45	7.09	10.90	6.14	12779	49.73	6.37	3.57	13625	57.36	35.78	11.90	8336
1.45-1.50	6.08	13.77	6.90	12241	55.81	7.18	3.93	13474	50.27	39.29	12.71	7710
1.50-1.60	8.15	17.38	8.06	11490	63.96	8.48	4.46	13221	44.19	42.80	13.51	7086
1.60-1.70	7.03	22.54	9.97	10567	70.99	9.87	5.00	12958	36.04	48.55	14.74	6090
1.70-1.80	3.46	28.63	12.11	9420	74.45	10.74	5.34	12794	29.01	54.85	15.90	5005
1.80-2.00	6.74	35.84	14.50	8247	81.19	12.83	6.10	12417	25.55	58.40	16.41	4408
2.00-SINKS	18.81	66.48	17.10	3032	100.00	22.92	8.17	10651	18.81	66.48	17.10	3032

SIZE FRACTION: -100 MESH

ASH %	SULPHUR %	BTU/lb*
30.0	9.25	14101

TABLE 45.

SAMPLE: ACI-84-121-012 PRINCE/HUB
SIZE FRACTION: -14 MESH TO +28 MESH (FLOAT-SINK 1984)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	78.01	4.94	1.48	8.71
1.30-1.35	73.76	4.76	1.37	8.44
1.35-1.40	70.58	4.44	1.25	7.84
1.40-1.45	65.75	4.15	1.17	6.95
1.45-1.50	**	**	**	**
1.50-1.60	56.90	3.59	1.00	6.13
1.60-1.70	53.15	3.38	0.93	5.96
1.70-1.80	47.52	3.10	0.82	5.84
1.80-2.00	40.48	2.66	0.60	5.70
2.00-SINKS	7.99	0.95	0.11	5.05

TABLE 46.

SAMPLE: ACI-84-121-012 PRINCE/HUB
SIZE FRACTION: -42 MESH TO +100 MESH (FLOAT-SINK 1985)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	77.56	4.95	1.55	7.99
1.30-1.35	74.86	4.81	1.31	8.45
1.35-1.40	70.39	4.43	1.11	8.78
1.40-1.45	65.54	3.09	1.07	10.00
1.45-1.50	64.52	3.94	1.04	8.62
1.50-1.60	60.14	3.54	0.92	8.58
1.60-1.70	54.55	3.27	0.85	8.39
1.70-1.80	40.11	2.09	0.57	9.57
1.80-2.00	38.02	2.41	0.37	7.88
2.00-SINKS	8.52	0.84	0.07	5.63

SIEVE FRACTION	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
-100 MESH	50.76	3.02	0.74	6.71

** insufficient sample

TABLE 47.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -14 MESH TO +28 MESH (FLOAT-SINK 1985)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS			
	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	80.48	5.16	1.04	5.74
1.30-1.35	75.58	4.47	0.91	5.52
1.35-1.40	73.25	4.60	0.81	5.58
1.40-1.45	70.80	4.43	0.84	5.55
1.45-1.50	68.12	4.18	0.74	5.66
1.50-1.60	63.29	3.69	0.57	5.52
1.60-1.70	57.40	3.25	0.68	5.43
1.70-1.80	51.97	2.85	0.57	5.84
1.80-2.00	43.52	2.50	0.50	6.09
2.00-SINKS	14.42	1.10	0.19	5.63

TABLE 48.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -42 MESH TO +100 MESH (FLOAT-SINK 1985)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS			
	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	82.03	5.52	1.09	6.86
1.30-1.35	78.55	5.32	1.10	6.86
1.35-1.40	74.21	5.00	0.87	6.68
1.40-1.45	70.68	4.60	0.97	6.66
1.45-1.50	66.68	4.36	0.71	6.49
1.50-1.60	62.60	4.03	0.84	6.68
1.60-1.70	56.68	3.69	0.71	6.73
1.70-1.80	51.64	3.39	0.67	7.02
1.80-2.00	45.41	2.95	0.66	6.67
2.00-SINKS	20.84	1.54	0.35	7.40

SIEVE FRACTION	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
-100 MESH	53.51	3.24	0.71	7.43

TABLE 49.

SAMPLE: ACI-84-121-006 MINTO/CHIPMAN #2
SIZE FRACTION: -14 TO +28 MESH 1.30 FLOAT
ZINC CHLORIDE SAMPLE SEPARATIONS

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS		
	CARBON %	HYDROGEN %	NITROGEN %
FLOAT-1.25	62.37	4.52	0.70
FLOAT-1.35	79.51	5.31	0.93
1.35-SINK	76.78	5.03	0.88

TABLE 50.

ZnCl2 SEPARATIONS
ACI-85-121-06 MINTO/CHIPMAN #2 -14 MESH TO +28 MESH MINERALIZED 1.30 FLOAT

SAMPLE I.D.	S0 (mg/g)	S1 (mg/g)	S2 (mg/g)	T MAX	T.O.C. (WT%)	O.P.I.	H.I.
	PRESENT HYDROCARBONS		POTENTIAL HYDROCARBONS	°C	(0.82(S1+S2)+S4)/10	S1/(S0+S1+S2)	100*S2/TOC
1.25 FLOAT	0.00	15.83	160.24	422	71.25	0.09	225
1.35 FLOAT	0.00	20.26	187.65	443	72.26	0.10	260
1.35 SINK	0.00	20.29	188.22	438	78.38	0.10	240

TABLE 51.

MACERAL ANALYSIS: Prince/Hub; -14m to +28m fraction, 1.3 float.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	87.8	87.8	95.4
	EXINITE	SPORINITE	4.8	6.4	
		CUTINITE	0.4		
		RESINITE	1.2		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	1.2	1.2	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	2.4	2.4	4.6
	INERTINITE	FUSINITE	0.2	1.4	
		MACRINITE	0.2		
		MICRINITE	1.0		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	0.4	0.8	
		QUARTZ	0.0		
		CLAYS	0.4		
		CARBONATES	0.0		

TABLE 52.

MACERAL ANALYSIS: Prince/Hub; -42m to +100m fraction, 1.3 float.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	86.8	86.8	94.3
	EXINITE	SPORINITE	5.2	6.2	
		CUTINITE	0.4		
		RESINITE	0.6		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	1.3	1.3	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	2.5	2.5	5.7
	INERTINITE	FUSINITE	0.6	3.0	
		MACRINITE	0.0		
		MICRINITE	2.4		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	0.2	0.2	
		QUARTZ	0.0		
		CLAYS	0.0		
		CARBONATES	0.0		

TABLE 53.

MACERAL ANALYSIS: Prince/Hub; -42m to +100m fraction, 1.5 sink.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	59.4	59.4	69.5
	EXINITE	SPORINITE	4.2	5.8	
		CUTINITE	0.0		
		RESINITE	1.6		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	4.3	4.3	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	8.7	8.7	30.5
	INERTINITE	FUSINITE	11.2	12.6	
		MACRINITE	0.0		
		MICRINITE	0.8		
		SCLEROTINITE	0.6		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	4.8	9.2	
		QUARTZ	0.6		
		CLAYS	3.8		
		CARBONATES	0.0		

TABLE 54.

MACERAL ANALYSIS: Prince/Hub; -42m to +100m fraction, 1.8 sink.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	38.6	38.6	41.3
	EXINITE	SPORINITE	1.2	1.2	
		CUTINITE	0.0		
		RESINITE	0.0		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	1.5	1.5	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	3.1	3.1	58.7
	INERTINITE	FUSINITE	22.2	22.6	
		MACRINITE	0.2		
		MICRINITE	0.2		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	10.8	33.0	
		QUARTZ	0.2		
		CLAYS	22.0		
		CARBONATES	0.0		

TABLE 55.

MACERAL ANALYSIS: Minto/Chipman 2; -14m to +28m fraction, 1.3 float.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	82.8	82.8	92.8
	EXINITE	SPORINITE	3.6	8.6	
		CUTINITE	0.0		
		RESINITE	5.0		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	1.4	1.4	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	2.8	2.8	7.2
	INERTINITE	FUSINITE	1.2	3.4	
		MACRINITE	0.0		
		MICRINITE	2.2		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	0.6	1.0	
		QUARTZ	0.0		
		CLAYS	0.4		
		CARBONATES	0.0		

TABLE 56.

MACERAL ANALYSIS: Minto/Chipman 2; -42m to +100m fraction, 1.3 float.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	86.0	86.0	93.8
	EXINITE	SPORINITE	4.0	6.4	
		CUTINITE	0.0		
		RESINITE	2.4		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	1.4	1.4	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	2.8	2.8	6.2
	INERTINITE	FUSINITE	0.4	3.0	
		MACRINITE	0.2		
		MICRINITE	2.4		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	0.4	0.4	
		QUARTZ	0.0		
		CLAYS	0.0		
		CARBONATES	0.0		

TABLE 57.

MACERAL ANALYSIS: Minto/Chipman 2; -42m to +100m fraction, 1.5 sink.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	49.4	49.4	66.6
	EXINITE	SPORINITE	4.2	8.2	
		CUTINITE	0.0		
		RESINITE	4.0		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	9.0	9.0	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	18.0	18.0	33.4
	INERTINITE	FUSINITE	4.8	6.4	
		MACRINITE	0.2		
		MICRINITE	1.4		
		SCLEROTINITE	0.0		
		INERTODETRINITE	0.0		
	MINERAL MATTER	PYRITE	6.8	9.0	
		QUARTZ	1.0		
		CLAYS	1.2		
		CARBONATES	0.0		

TABLE 58.

MACERAL ANALYSIS: Minto/Chipman 2; -42m to +100m fraction, 1.8 sink.

COMPONENT	MACERAL GROUP	MACERAL	MACERAL VOL. %	MACERAL GROUP VOL. %	COMPONENT VOL. %
REACTIVE	VITRINITE	VITRINITE	45.2	45.2	56.9
	EXINITE	SPORINITE	3.8	5.6	
		CUTINITE	0.0		
		RESINITE	1.8		
	SEMI-INERTINITE	REACTIVE SEMIINERTINITE	6.1	6.1	
INERT	SEMI-INERTINITE	INERT SEMIINERTINITE	12.1	12.1	43.1
	INERTINITE	FUSINITE	5.6	7.6	
		MACRINITE	1.0		
		MICRINITE	0.6		
		SCLEROTINITE	0.2		
		INERTODETRINITE	0.2		
	MINERAL MATTER	PYRITE	11.6	23.4	
		QUARTZ	1.0		
		CLAYS	10.8		
		CARBONATES	0.0		

TABLE 59. MACERAL COMPOSITION - mineral matter free basis
Parkash et al., 1985, Float-Sink Fractions

SITE	S.G. fractions: GROUP MACERALS (vol %)	<1.35	1.35-1.45	1.45-1.55	1.55-1.60	>1.60
VESTA COAL	VITRINITE	89.5	91.0	82.8	76.2	72.5
	EXINITE	5.3	2.8	1.9	1.5	1.5
	SEMI-INERTINITE	2.8	2.1	6.8	6.0	5.0
	INERTINITE	2.4	4.1	8.5	16.3	21.0

TABLE 60. MACERAL COMPOSITION - mineral matter free basis
This Study

SITE	S.G. fractions: GROUP MACERALS (vol %)	<1.30	1.50-1.60	1.80-2.00
PRINCE/HUB	VITRINITE	87.0	65.4	57.6
	EXINITE	6.2	6.4	1.8
	SEMI-INERTINITE	3.8	14.3	6.9
	INERTINITE	3.0	13.9	33.7
MINTO/CHIPMAN2	VITRINITE	86.4	54.3	59.0
	EXINITE	6.4	9.0	7.3
	SEMI-INERTINITE	4.2	29.7	23.8
	INERTINITE	3.0	7.0	9.9

TABLE 61.

PLASTOMETRY MINTO/CHIPMAN #2
-14 + 28 MESH

	1.30 FLOAT	1.50 SINK	1.60 SINK #
INITIAL SOFTENING TEMP.(DEG C)	394	415	439
TEMP. OF MAX. FLUIDITY	444	445	440
SOLIDIFICATION TEMP.	494	484	459
MAXIMUM FLUIDITY (DDPM)*	32992.1	31.0	1.1

* DIAL DIVISIONS PER MINUTE # NO SOFTENING FOR 1.70 SINK

INSUFFICIENT SAMPLE FOR PRINCE/HUB FLOAT SINK FRACTION PLASTOMETRY

TABLE 62.

DILATOMETRY MINTO/CHIPMAN #2
-14 + 28 MESH

	1.30 FLOAT	1.50 SINK	1.70 SINK #
SOFTENING TEMP. (DEG C)	346	385	408
CONTRACTION TEMP.	411	436	472
TEMP.OF MAX DILATATION	490	-	-
PERCENT CONTRACTION	33	29	19
PERCENT EXPANSION	202	-	-
G FACTOR	1.17	-	-

# NO SOFTENING FOR 2.00 SINK

TABLE 63.

DILATOMETRY PRINCE/HUB
-14 + 28 MESH

	1.30 FLOAT	1.30 SINK	1.35 SINK	1.40 SINK
SOFTENING TEMP. (DEG C)	399	383	392	392
CONTRACTION TEMP.	437	465	457	458
TEMP.OF MAX DILATATION	-	-	-	-
PERCENT CONTRACTION	27	32	29	23
PERCENT EXPANSION	-	-	-	-
G FACTOR	-	-	-	-

FIGURE 9.

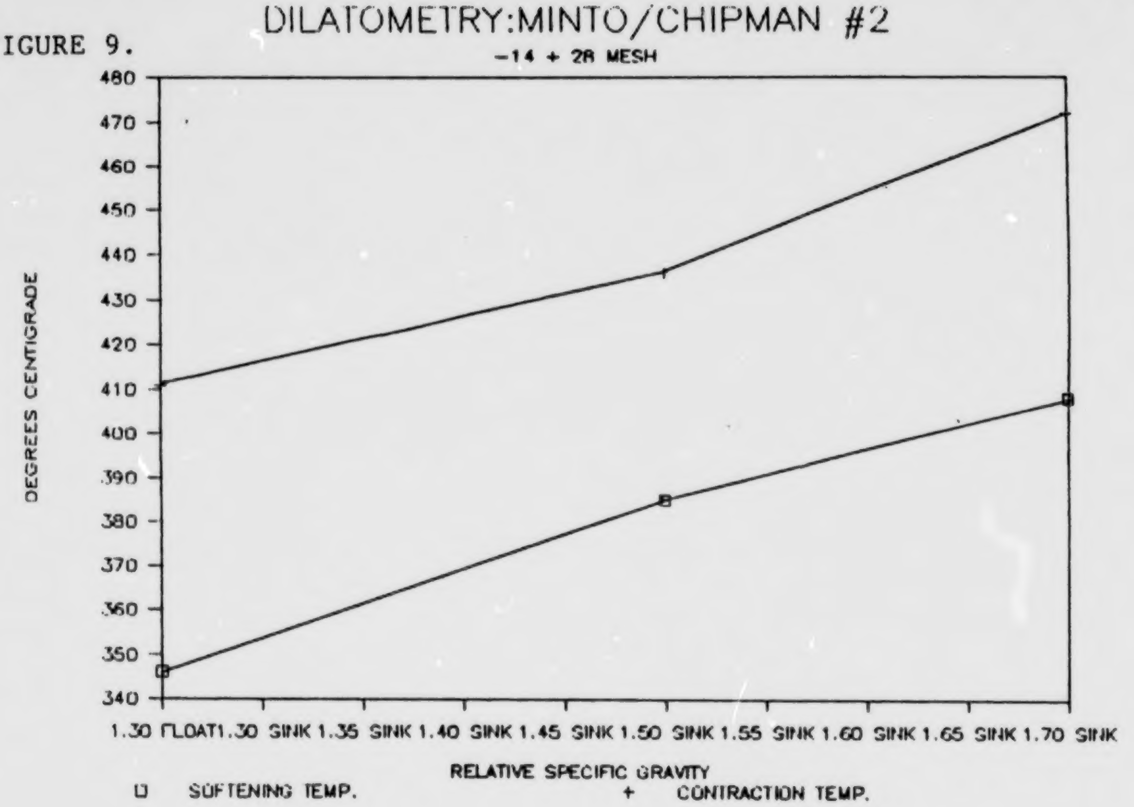


FIGURE 10.

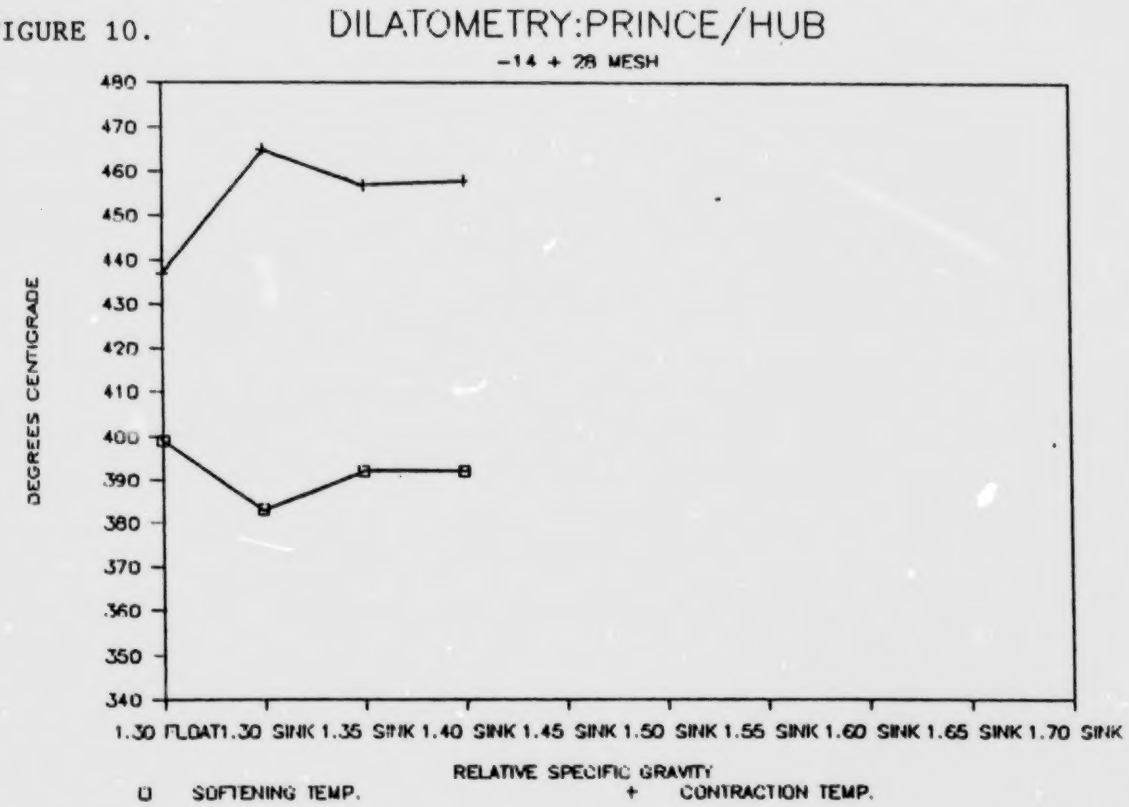


TABLE 64.

LOW TEMPERATURE ASH (LTA) * MINERAL SEPARATIONS
ACI-85-121-012 PRINCE/HUB H.C. -42 TO +100 MESH

RELATIVE SPECIFIC GRAVITY FRACTIONS	RECOVERY WT % 2.00 FLOAT	RECOVERY WT % 2.85 FLOAT	RECOVERY WT % 2.85 SINK	RECOVERY WT % TOTAL
1.30 FLOAT	0.46	90.44	1.79	92.69
1.50 SINK	0.26	19.06	93.06	112.38
1.80 SINK	2.99	57.54	40.78	101.31

TABLE 65.

LOW TEMPERATURE ASH (LTA)* MINERAL SEPARATIONS
ACI-85-121-06 MINTO/CHIPMAN #2 -42 TO +100 MESH

RELATIVE SPECIFIC GRAVITY FRACTIONS	RECOVERY WT % 2.00 FLOAT	RECOVERY WT % 2.85 FLOAT	RECOVERY WT % 2.85 SINK	RECOVERY WT % TOTAL
1.30 FLOAT	37.41	27.89	17.18	82.48
1.50 SINK	0.25	2.09	81.12	83.46
1.80 SINK	0.74	17.89	79.61	98.24

* SEM-EDX ANALYSIS COMPLETED ON EACH FRACTION

APPENDIX I

D. DATA REPRODUCIBILITY

TABLE 66.

SAMPLE: ACI-84-121-012 PRINCE/HUB HC ANALYZED 1985
SIZE FRACTION: -42 MESH TO +100 MESH

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTARY DATA				CUMULATIVE DATA							
					FLOAT				SINK			
	MASS %	ASH %	SULPHUR	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	31.94	3.90	1.77	13878	31.94	3.90	1.77	13878	100.00	28.95	4.29	9466
1.30-1.35	17.15	4.44	2.41	13597	49.09	4.09	1.99	13780	68.06	40.71	5.47	7396
1.35-1.40	4.29	8.49	3.87	12781	53.38	4.44	2.14	13700	50.91	52.92	6.51	5307
1.40-1.45	4.43	13.98	3.27	11160	57.81	5.17	2.23	13505	46.62	57.01	6.75	4619
1.45-1.50	2.34	14.26	5.51	11533	60.15	5.53	2.36	13428	42.19	61.53	7.11	3932
1.50-1.60	5.74	19.15	6.28	10803	65.89	6.71	2.70	13200	39.85	64.30	7.21	3486
1.60-1.70	2.08	26.30	7.89	9581	67.97	7.31	2.86	13089	34.11	71.90	7.36	2255
1.70-1.80	1.86	40.76	5.37	6978	69.83	8.20	2.93	12926	32.03	74.86	7.33	1779
1.80-2.00	3.69	43.65	9.04	6606	73.52	9.98	3.23	12609	30.17	76.97	7.45	1458
2.00-SINKS	26.48	81.61	7.23	741	100.00	28.95	4.29	9466	26.48	81.61	7.23	741

TABLE 67.

SAMPLE: ACI-84-121-012 PRINCE/HUB HC ANALYZED 1984
SIZE FRACTION: -42 MESH TO +100 MESH

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTARY DATA				CUMULATIVE DATA							
					FLOAT				SINK			
	MASS %	ASH %	SULPHUR	BTU/lb*	MASS %	ASH %	SULPHUR %	BTU/lb*	MASS %	ASH%	SULPHUR %	BTU/lb*
FLOAT-1.30	21.74	1.85	1.24	13931	21.74	1.85	1.24	13931	100.00	28.49	4.19	9679
1.30-1.35	9.54	3.38	1.59	13515	31.28	2.32	1.35	13804	78.26	35.89	5.01	8498
1.35-1.40	0.41	5.62	1.61	13117	31.69	2.36	1.35	13795	68.72	40.41	5.48	7802
1.40-1.45	18.49	5.22	2.06	13223	50.18	3.41	1.61	13584	68.31	40.62	5.51	7770
1.45-1.50	8.59	10.18	3.82	12507	58.77	4.40	1.93	13427	49.82	53.75	6.79	5746
1.50-1.60	4.93	14.84	4.63	11785	63.70	5.21	2.14	13300	41.23	62.83	7.41	4338
1.60-1.70	3.06	26.29	6.68	9917	66.76	6.18	2.35	13145	36.30	69.35	7.78	3326
1.70-1.80	3.36	38.26	7.93	7982	70.12	7.71	2.62	12897	33.24	73.32	7.88	2720
1.80-2.00	5.37	59.96	7.11	4604	75.49	11.43	2.94	12307	29.88	77.26	7.88	2128
2.00-SINKS	24.50	81.08	8.05	1586	99.99	28.50	4.19	9680	24.51	81.05	8.05	1585

TABLE 68.

SAMPLE: ACI-84-121-012 PRINCE/HUB HC
SIZE FRACTION: -42 MESH TO +100 MESH

ELEMENTARY DATA

RELATIVE SPECIFIC-GRAVITY FRACTIONS	1985 MASS %	1984 MASS %	1985 ASH %	1984 ASH %	1985 SULPHUR %	1984 SULPHUR %	1985 BTU/lb*	1984 BTU/lb*
FLOAT-1.30	31.94	21.74	3.90	1.85	1.77	1.24	13878	13931
1.30-1.35	17.15	9.54	4.44	3.38	2.41	1.59	13597	13515
1.35-1.40	4.29	0.41	8.49	5.62	3.87	1.61	12781	13117
1.40-1.45	4.43	18.49	13.98	5.22	3.27	2.06	11160	13223
1.45-1.50	2.34	8.59	14.26	10.18	5.51	3.82	11533	12507
1.50-1.60	5.74	4.93	19.15	14.84	6.28	4.63	10803	11785
1.60-1.70	2.08	3.06	26.30	26.29	7.89	6.68	9581	9917
1.70-1.80	1.86	3.36	40.76	38.26	5.37	7.93	6978	7982
1.80-2.00	3.69	5.37	43.65	59.96	9.04	7.11	6606	4604
2.00-SINKS	26.48	24.50	81.61	81.08	7.23	8.05	741	1586

* sulphur corrected

TABLE 69.

SAMPLE: ACI-84-121-012 PRINCE/HUB
SIZE FRACTION: -42 MESH TO +100 MESH (FLOAT-SINK 1985)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS			
	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	77.56	4.95	1.55	7.99
1.30-1.35	74.86	4.81	1.31	8.45
1.35-1.40	70.39	4.43	1.11	8.78
1.40-1.45	65.54	3.09	1.07	10.00
1.45-1.50	64.52	3.94	1.04	8.62
1.50-1.60	60.14	3.54	0.92	8.58
1.60-1.70	54.55	3.27	0.85	8.39
1.70-1.80	40.11	2.09	0.57	9.57
1.80-2.00	38.02	2.41	0.37	7.88
2.00-SINKS	8.52	0.84	0.07	5.63

TABLE 70.

SAMPLE: ACI-84-121-012 PRINCE/HUB
SIZE FRACTION: -42 MESH TO +100 MESH (FLOAT-SINK 1984)

RELATIVE SPECIFIC-GRAVITY FRACTIONS	ELEMENTAL ANALYSIS			
	CARBON %	HYDROGEN %	NITROGEN %	OXYGEN %
FLOAT-1.30	77.57	5.09	1.50	8.46
1.30-1.35	75.24	4.91	1.49	7.17
1.35-1.40	72.53	4.54	1.26	7.33
1.40-1.45	73.40	4.85	1.36	6.99
1.45-1.50	68.94	4.46	1.23	7.02
1.50-1.60	64.81	3.91	1.10	6.84
1.60-1.70	53.80	3.22	0.89	6.33
1.70-1.80	42.65	2.70	0.67	6.51
1.80-2.00	25.39	1.80	0.44	5.65
2.00-SINKS	7.17	0.78	0.11	4.74

TABLE 71.

PLASTOMETRY: COMPARISON BETWEEN 1984 AND 1986 RUNS

SAMPLE: HOMER CITY/HUB -1/2" SUBSAMPLE

DEGREES CENTIGRADE	1984 RUN	1986 RUN #1	1986 RUN #2	STD. DEVIATION BETWEEN 1986 RUN 1 AND 2	@ STD. DEVIATION BETWEEN 1984 AND1986
INITIAL SOFTENING TEMP.	386	400	405	3.5	12.0
TEMP. OF MAX FLUIDITY	431	441	438	2.1	6.4
SOLIDIFICATION TEMP.	446	461	459	1.4	9.9
MAX. FLUIDITY (D.D.P.M.)*	13.8	0.7	0.8	0.0	9.2

* DIAL DIVISIONS PER MINUTE
@ 1986 RUN 1 AND 2 ARE AVARAGED FOR COMPARISON WITH 1984 RUN

TABLE 72.

DILATOMETRY: COMPARISON BETWEEN 1984 AND 1986 RUNS

SAMPLE: HOMER CITY/HUB -1/2" SUBSAMPLE

DEGREES CENTIGRADE	1984 RUN	1986 RUN #1	1986 RUN #2	STD. DEVIATION BETWEEN 1986 RUN 1 AND 2	STD. DEVIATION BETWEEN 1984 AND1986
INITIAL SOFTENING TEMP.	383	402	407	3.5	15.6
CONTRACTION TEMP.	470	451	451	0.0	13.4
TEMP OF MAX. DILATATION	-	-	-	-	-
MAX. CONTRACTION	14 %	36 %	19 %	12.0	9.9
MAX. EXPANSION	-	-	-	-	-
G FACTOR	-	-	-	-	-

TABLE 73.

PLASTOMETRY: COMPARISON BETWEEN 1984 AND 1986 RUNS

SAMPLE: MINTO/CHIPMAN #2 -1/2" SUBSAMPLE

DEGREES CENTIGRADE	1984 RUN	1986 RUN #1	1986 RUN #2	STD. DEVIATION BETWEEN 1986 RUN 1 AND 2	@ STD. DEVIATION BETWEEN 1984 AND1986
INITIAL SOFTENING TEMP.	357	404	409	3.5	35.4
TEMP. OF MAX FLUIDITY	422	441	442	0.7	14.1
SOLIDIFICATION TEMP.	463	486	478	5.7	13.4
MAX. FLUIDITY (D.D.P.M.)*	31792.0	1759.7	1264.9	349.9	21410.3

* DIAL DIVISIONS PER MINUTE
@ 1986 RUN 1 AND 2 ARE AVARAGED FOR COMPARISON WITH 1984 RUN

TABLE 74.

DILATOMETRY: COMPARISON BETWEEN 1984 AND 1986 RUNS

SAMPLE: MINTO/CHIPMAN #2 -1/2" SUBSAMPLE

DEGREES CENTIGRADE	1984 RUN	1986 RUN #1	1986 RUN #2	STD. DEVIATION BETWEEN 1986 RUN 1 AND 2	STD. DEVIATION BETWEEN 1984 AND1986
INITIAL SOFTENING TEMP.	353	358	373	10.6	9.2
CONTRACTION TEMP.	-	421	421	0.0	-
TEMP OF MAX. DILATATION	431	454	454	0.0	16.3
MAX. CONTRACTION	16 %	33 %	28 %	3.5	10.6
MAX. EXPANSION	14 %	28 %	34 %	4.2	12.0
G FACTOR	0.99	0.99	1.01	0.0	0.0

APPENDIX II

SCANNING ELECTRON MICROSCOPY

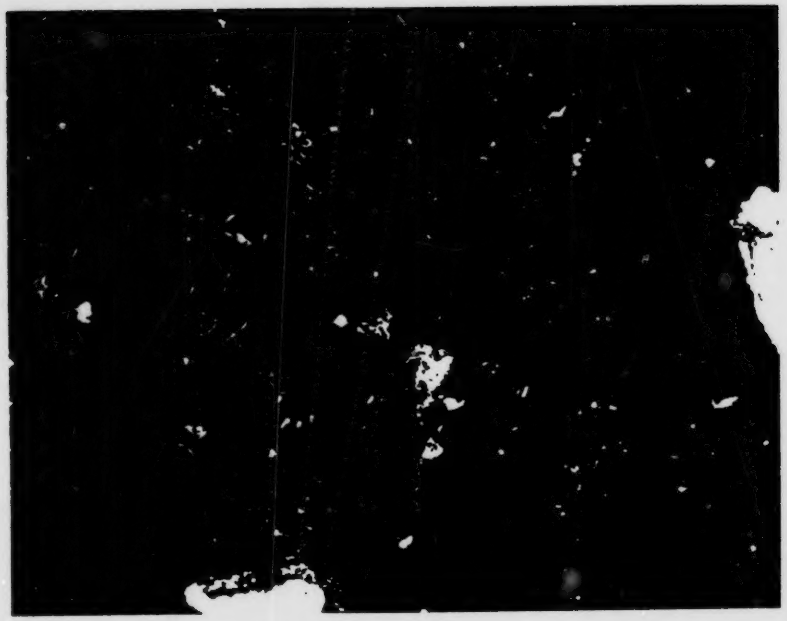
LIST OF ABBREVIATIONS

BEI	Backscatter Electron Image (atomic no difference)
SEI	Secondary Electron Image (morphology and topography)
PRC	Particle Recognition and Characterization Program
LTA	Low Temperature Ash
Q	Quartz
Bi	Biotite
Z	Zircon
FeSi	Iron Silicate
Sd	Siderite
C	Calcite
Dol	Dolimite
An	Ankerite
I	Illite
I=Ti	Titanium bearing illite
K	Kaolinite
Ch	Chlorite
P	Pyrite
P+As	Arsenic bearing pyrite (arsenopyrite?)
CP	Chalcopyrite
G	Galena
Sp	Sphalerite
Pr	Pyrrhotite
Gy	Gypsum
Ba	Barite
R	Halite
Ap	Apatite
Mz	Monazite

PLATE 1

MINERAL ANALYSIS
Prince/Hub -1/2" subsample, crushed to -20 mesh

Photo No.	Index No.	Description	Spectra No.
1	1023-02	Area view; 35x; BEI	
2	1023-03	Grain #1; 100x; BEI	1, 2, 3, 4, 5
3	D925-01	Grain #2; 150x; BEI	6, 7
4	0925-02	Grain #2; 150x; BEI	8, 9, 10



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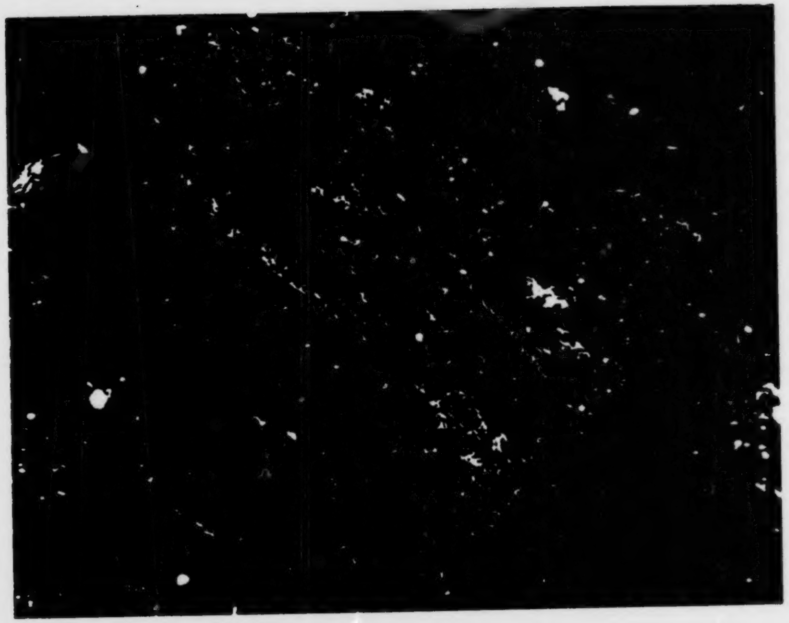

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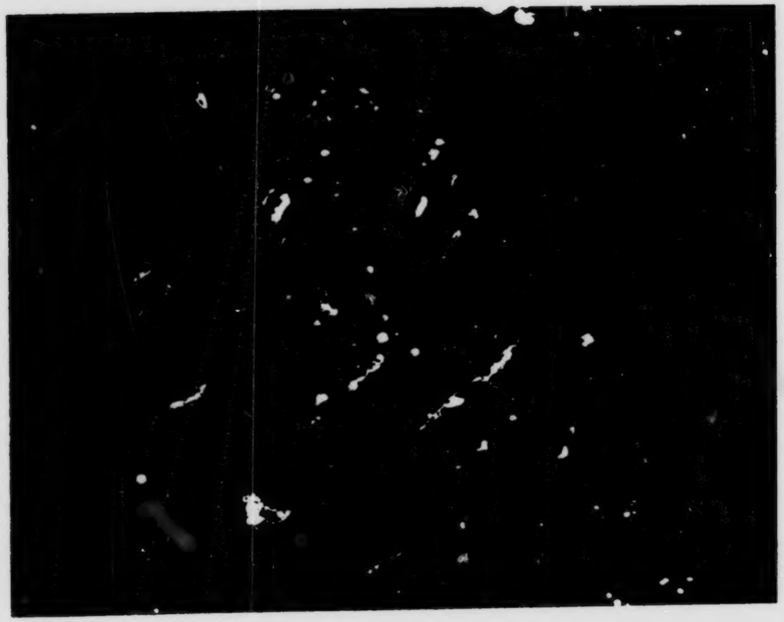

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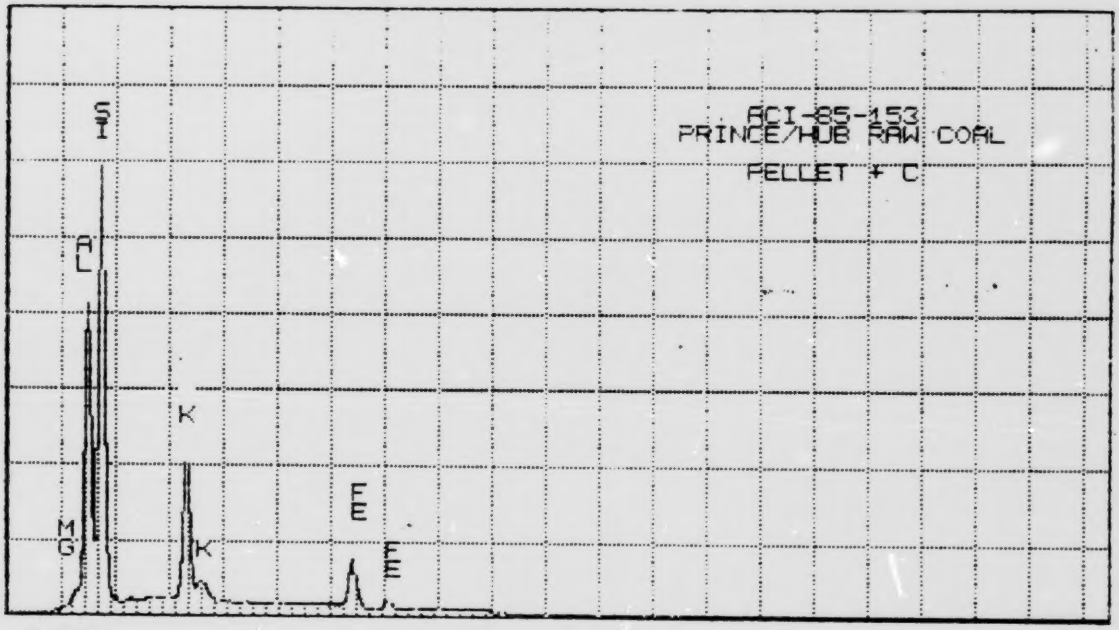

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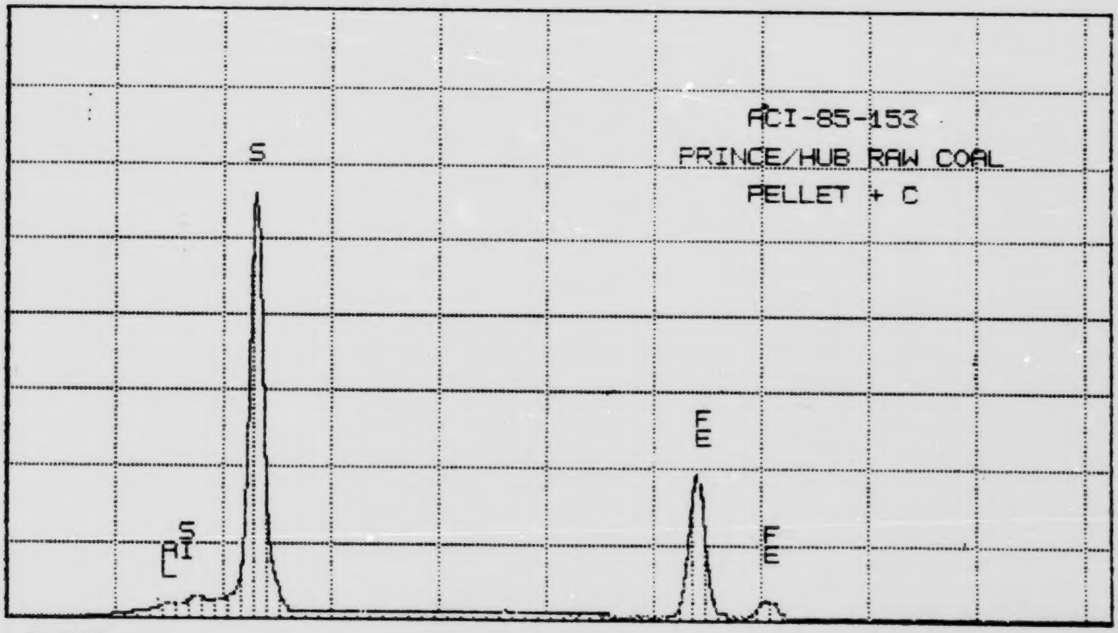

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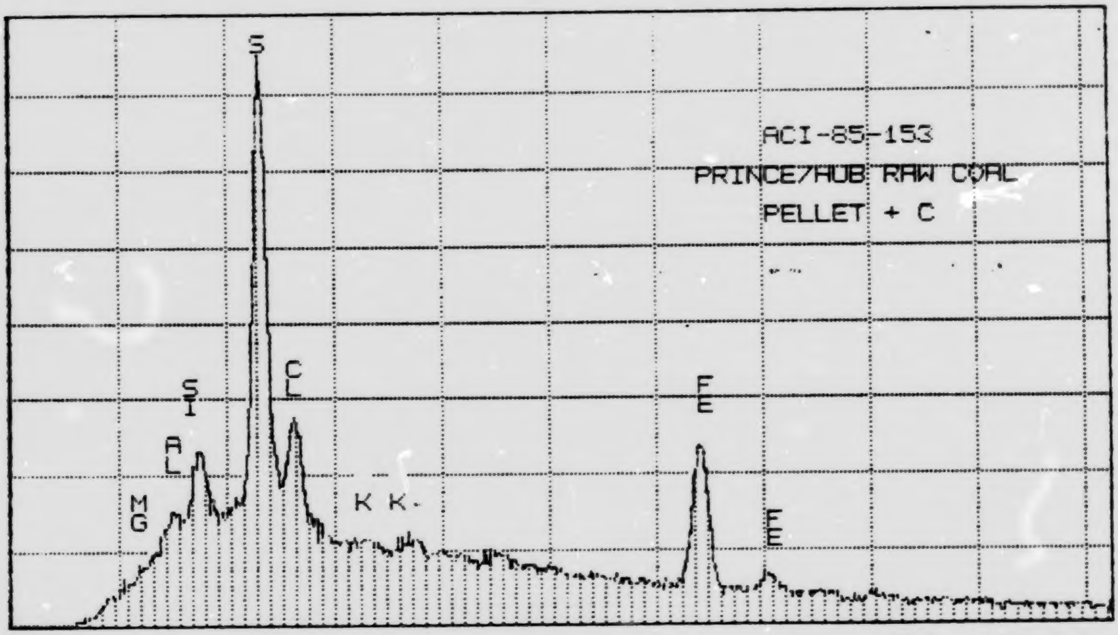

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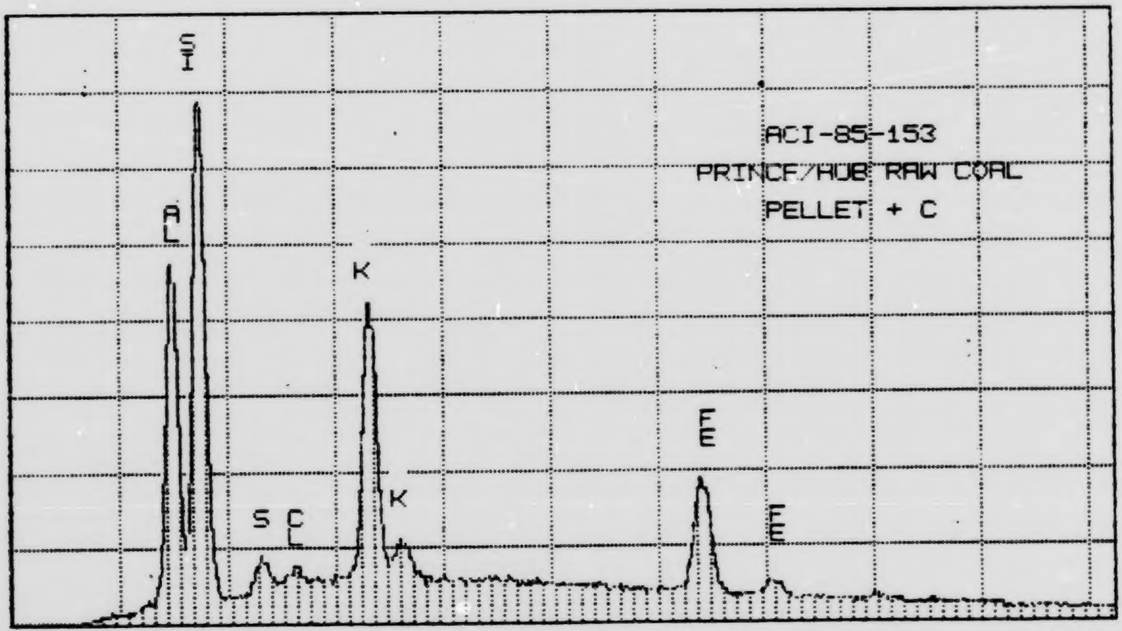

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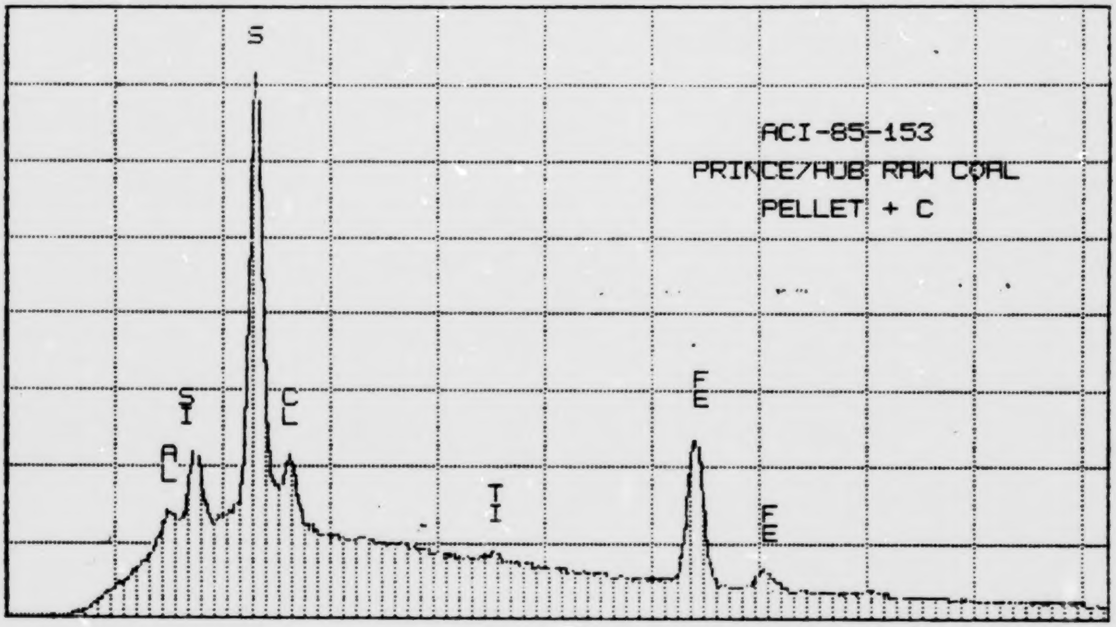

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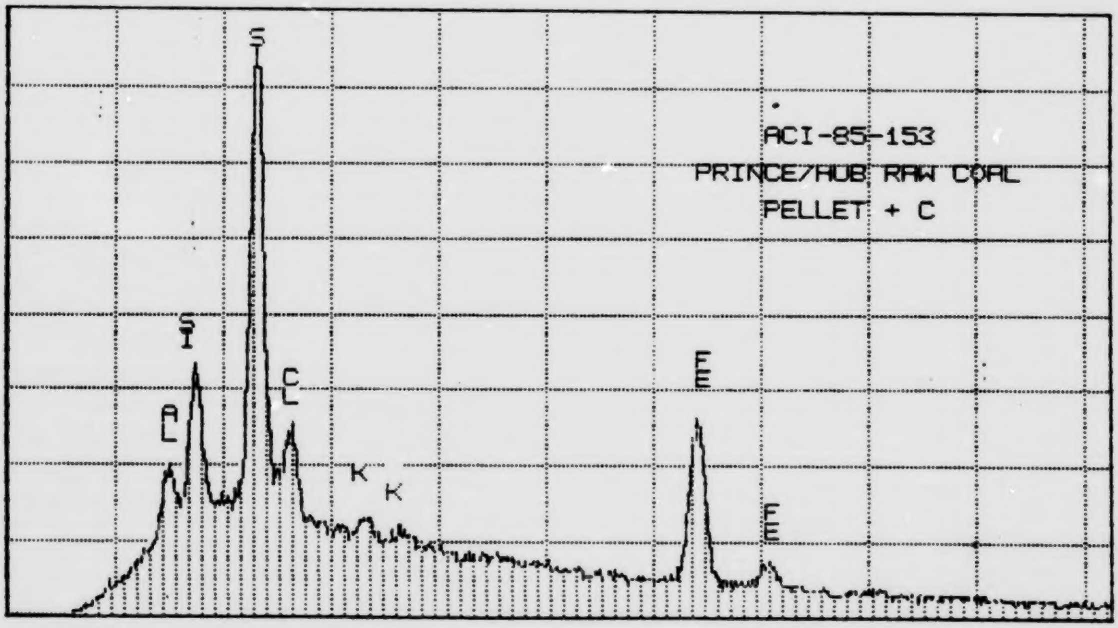

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50 MATRIX: PHOTO#0925-01,EDX6

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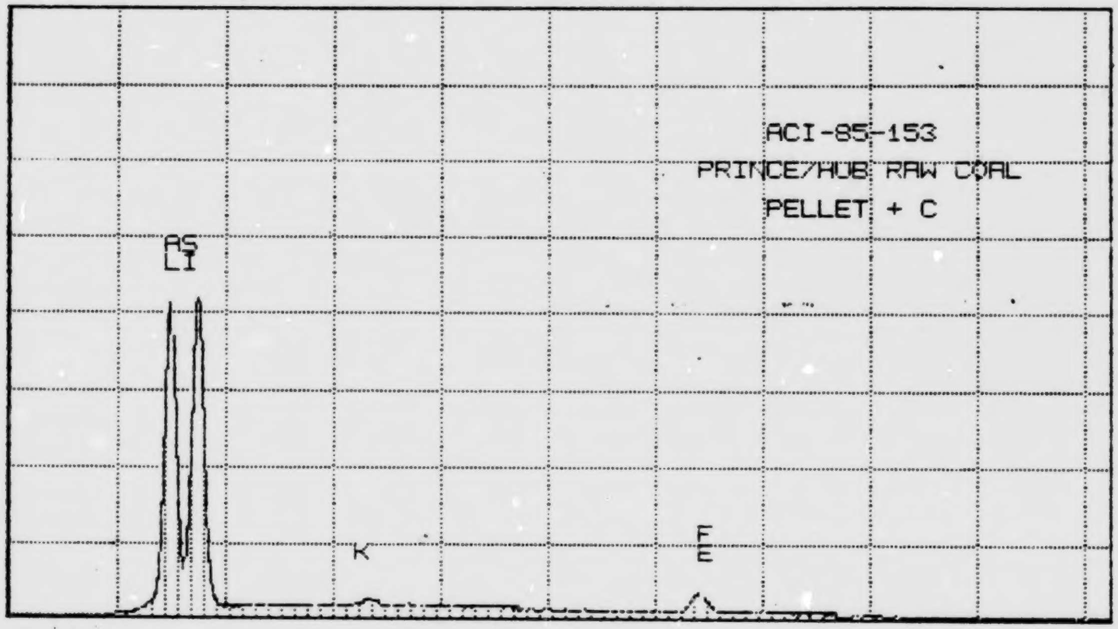

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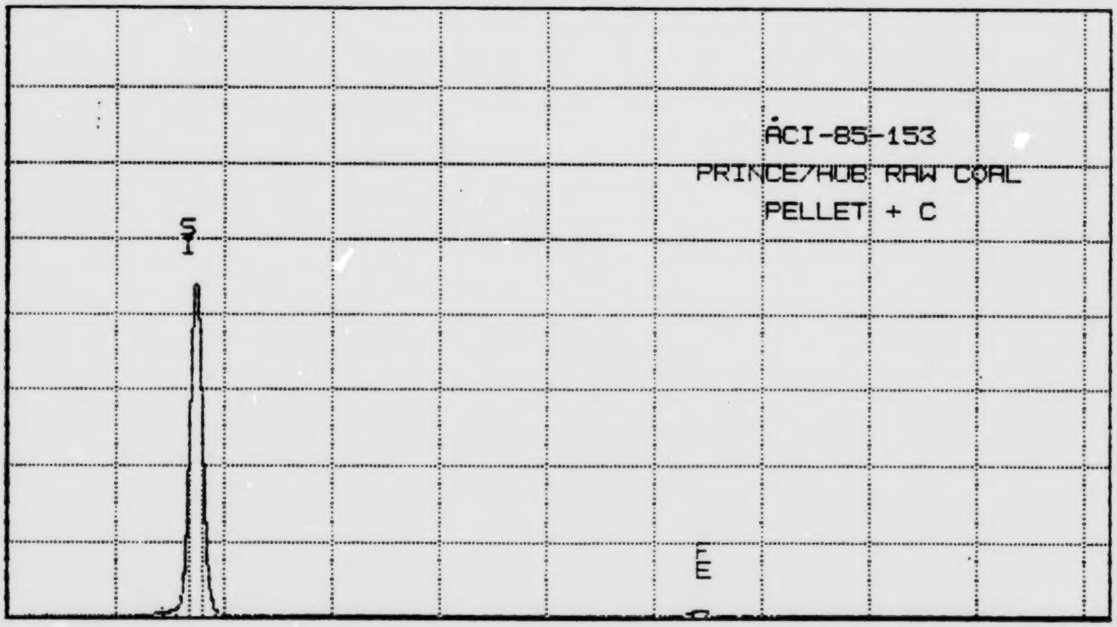

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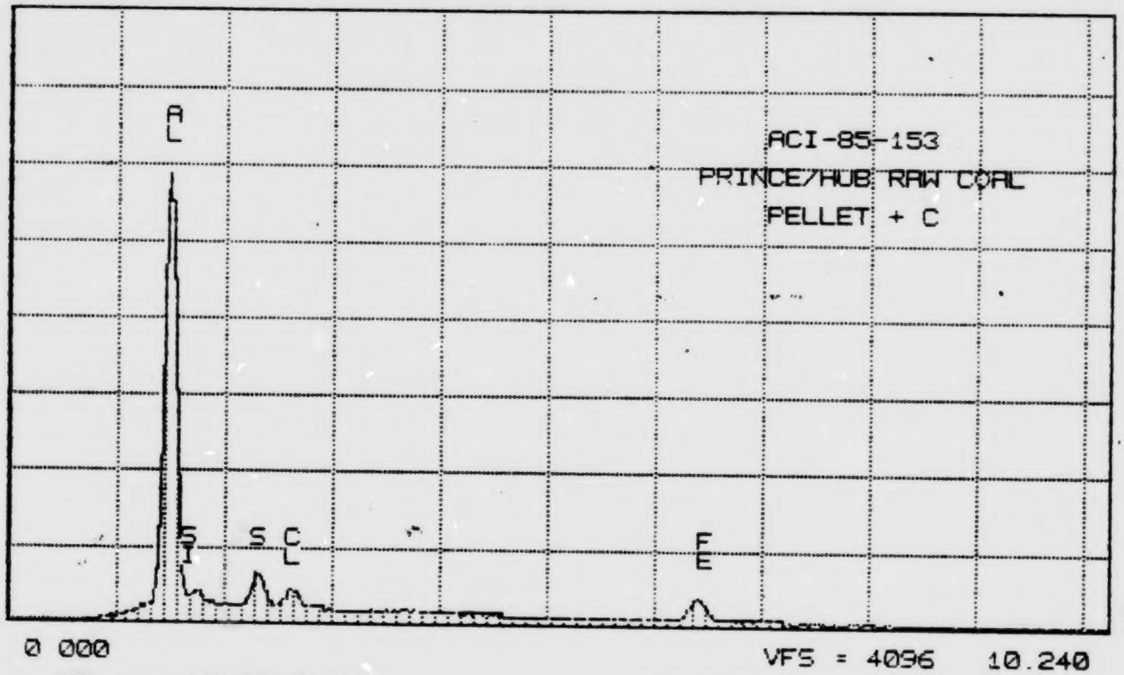

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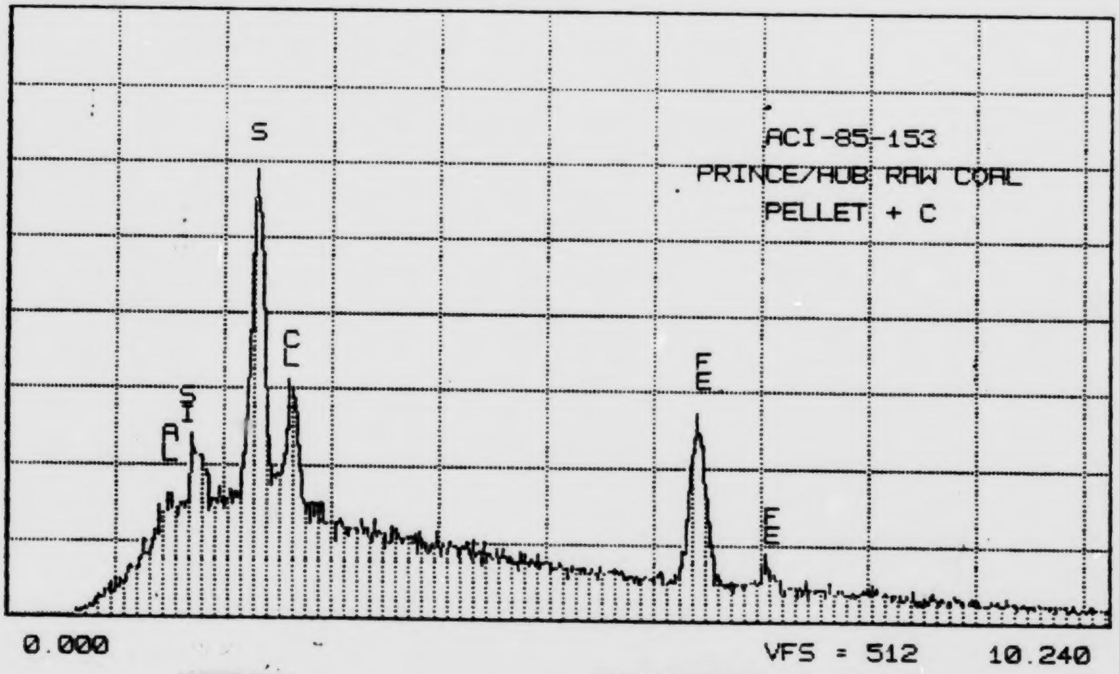

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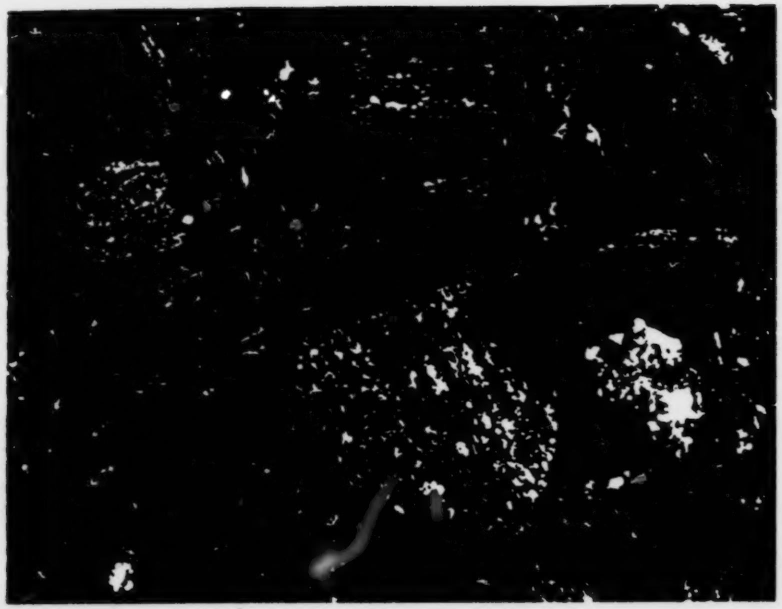
MATRIX: PHOTO#0925-02,EDX10 50

PLATE 2

MINERAL ANALYSIS
Minto/Chipman #2 -1/2" subsample, crushed to -20 mesh

Photo No.	Index No.	Description	Spectra No.
1	1006-01	Area view; 50x; BEI	
2	1006-02	Grain #1; 200x; BEI	1, 2, 3
3	1006-03	Grain #2; 100x; BEI	4, 5
4	1006-04	Grain #3; 150x; BEI	6,7,8,9,10,11
5	1006-05	Enlargement of surface contaminat, upper right of P#4	10



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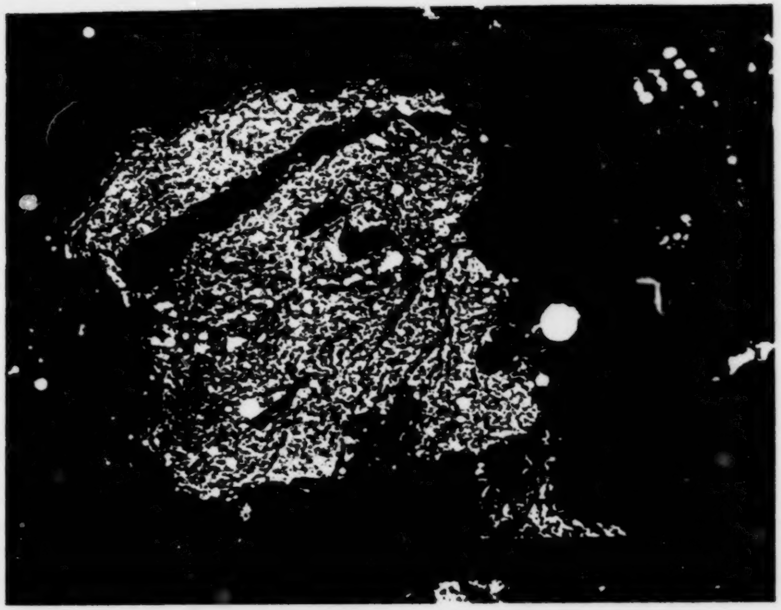

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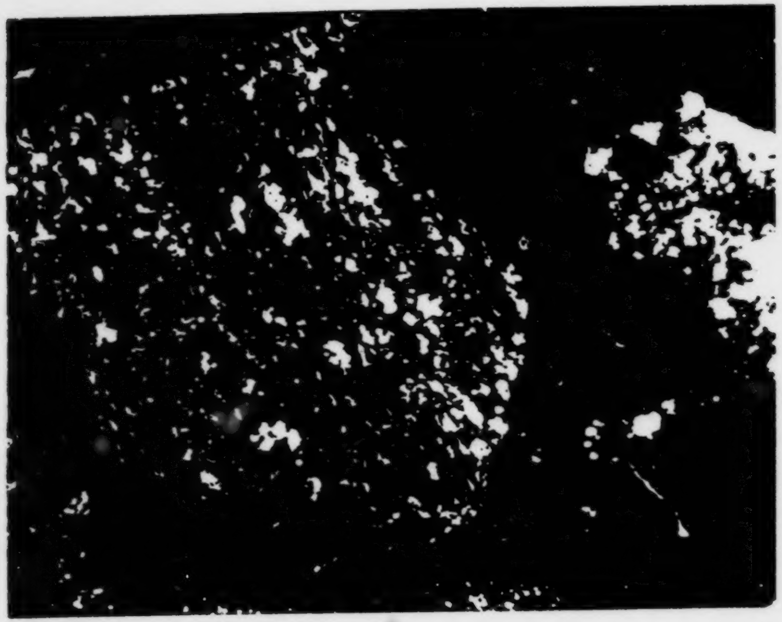

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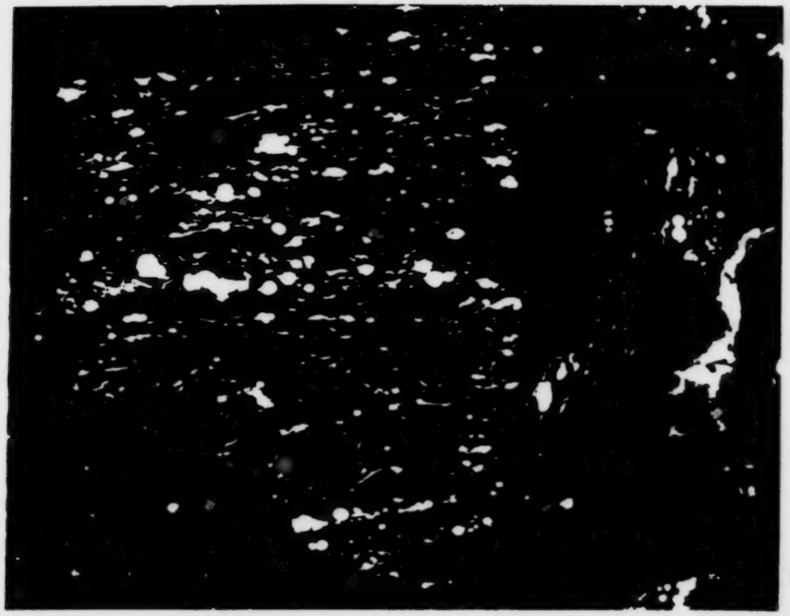

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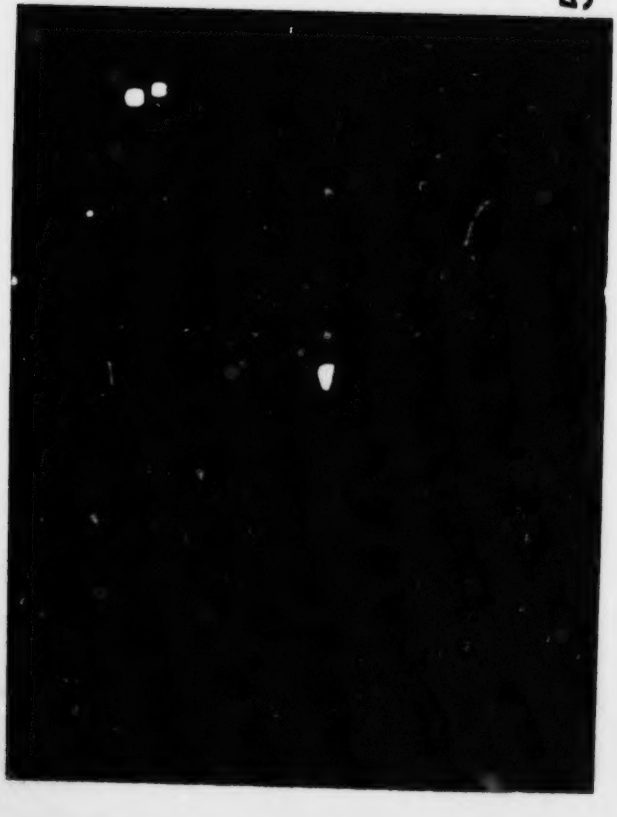

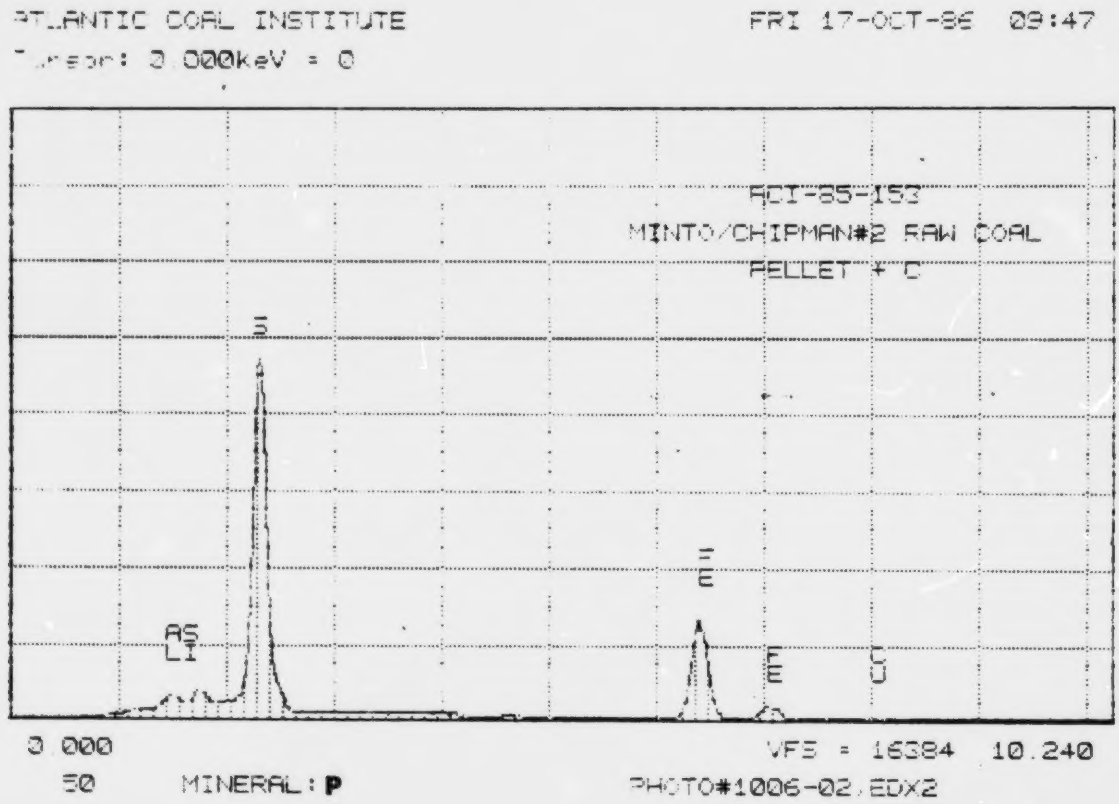

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 09:47

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ACI-85-153

MINTO/CHIPMAN#2 RAW COAL

PELLET + C

0.000 VFS = 16384 10.240

50 MINERAL: **P** PHOTO#1006-02,EDX2

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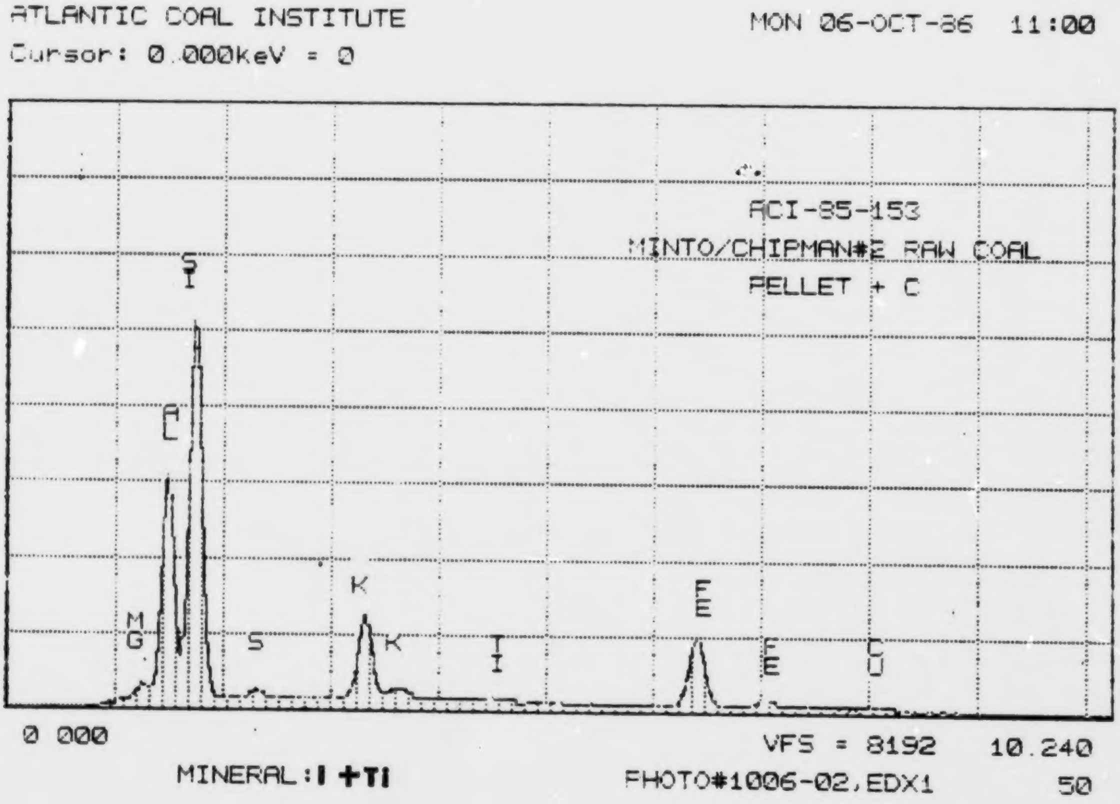

ATLANTIC COAL INSTITUTE MON 06-OCT-86 11:00

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ACI-85-153

MINTO/CHIPMAN#2 RAW COAL

PELLET + C

0.000 VFS = 8192 10.240

MINERAL: **I +TI** PHOTO#1006-02,EDX1 50

2

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 09:50

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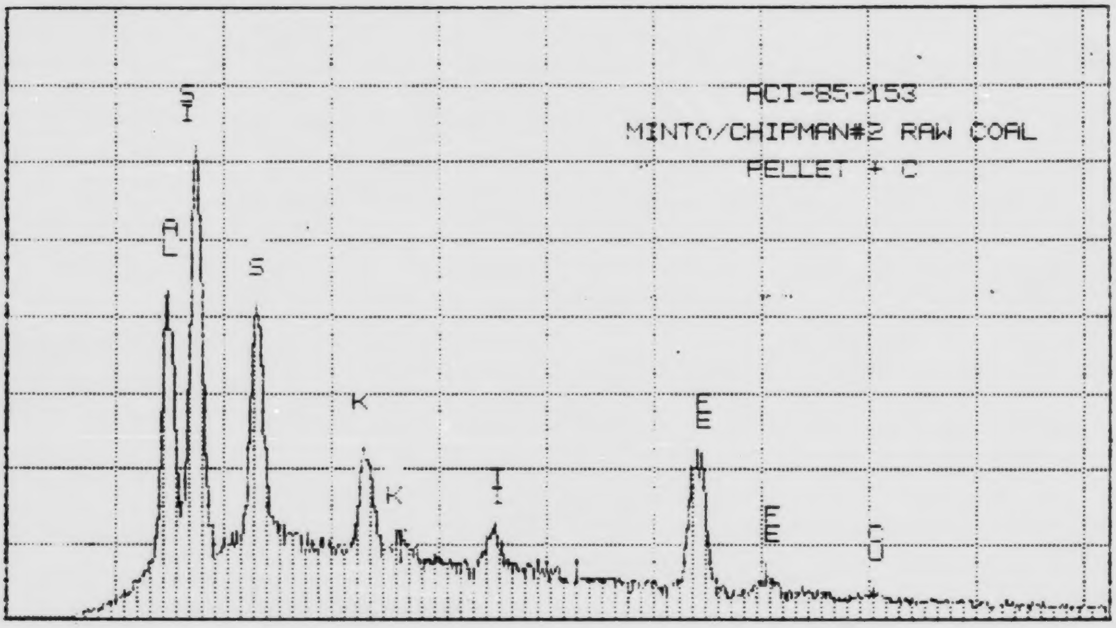

ACI-85-153
MINTO/CHIPMAN#2 RAW COAL
PELLET + C

3

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50 MATRIX: PHOTO#1006-02,EDX3

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 09:52

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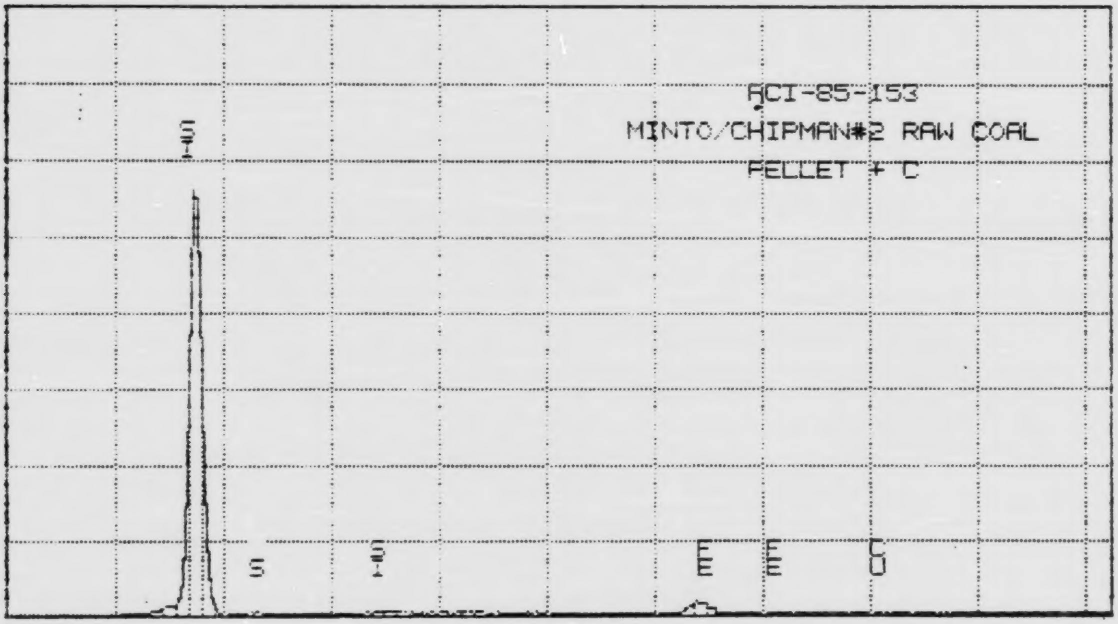

ACI-85-153
MINTO/CHIPMAN#2 RAW COAL
PELLET + C

4

0.000 VFS = 16384 10.240

50 MINERAL:**Q** PHOTO#1006-03,EDX4

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 09:54
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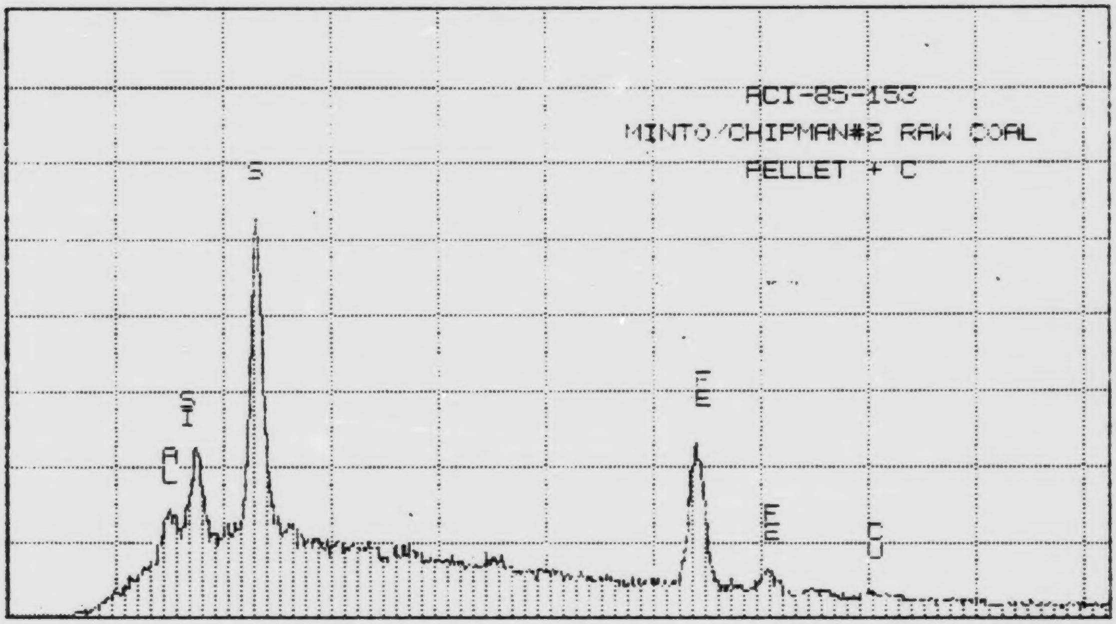

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0.000 VFS = 1024 10.240
50 MATRIX: PHOTO#1006-03,EDX5

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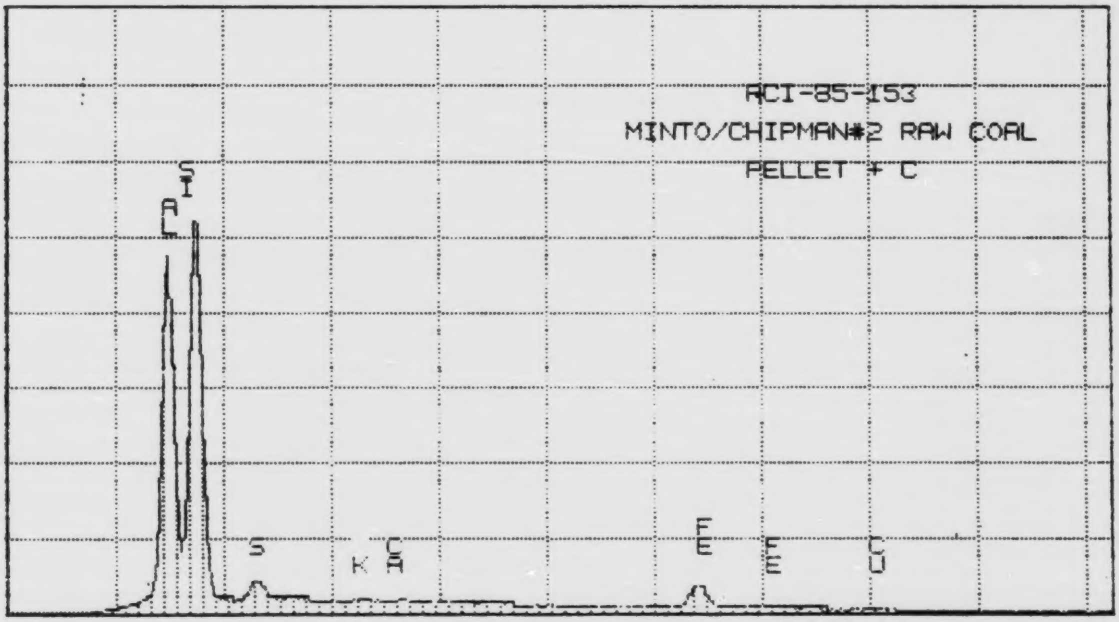

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0.000 VFS = 8192 10.240
50 MINERAL:K PHOTO#1006-04,EDX6

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 09:59

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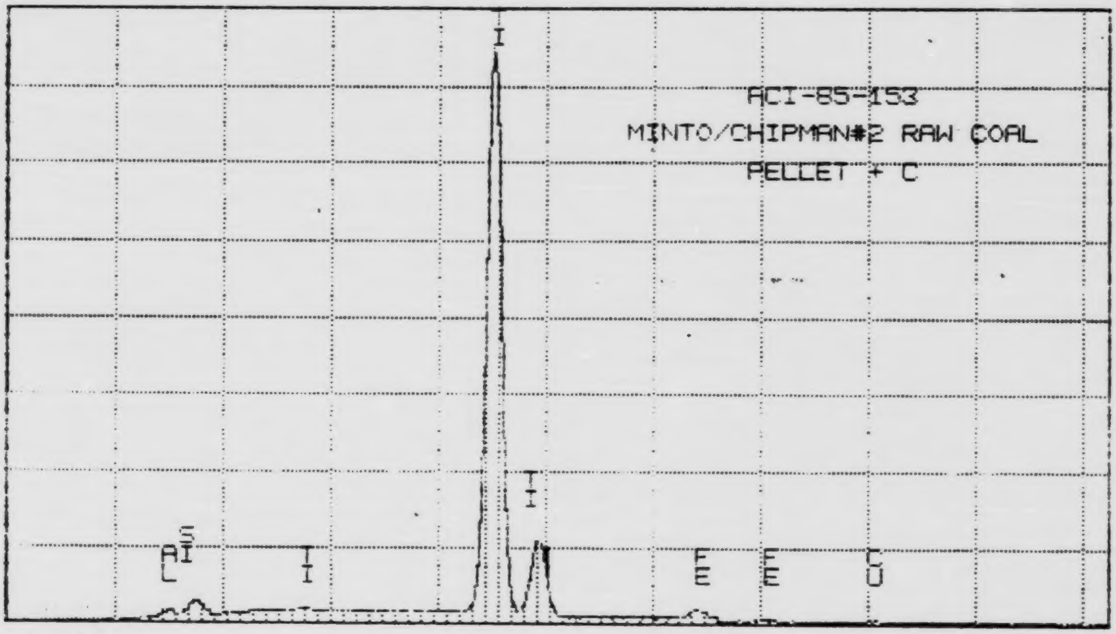

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50 MINERAL: **R** PHOTO#1006-04,EDX7

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:01

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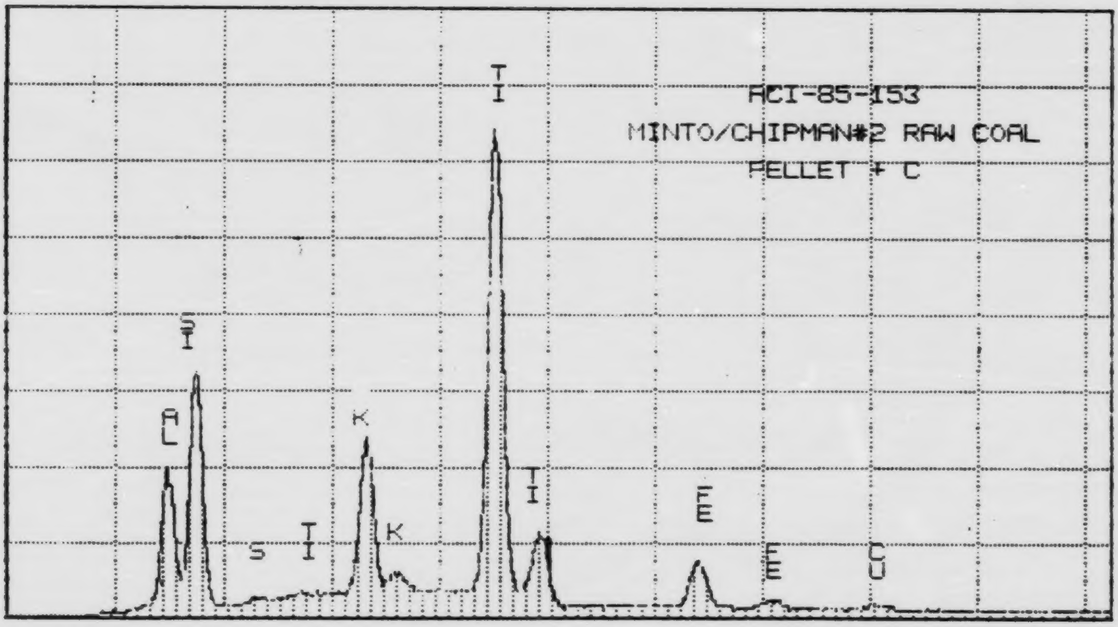

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0.000 VFS = 4096 10.240

50 MINERAL: **I + R** PHOTO#1006-04,EDX8

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:03

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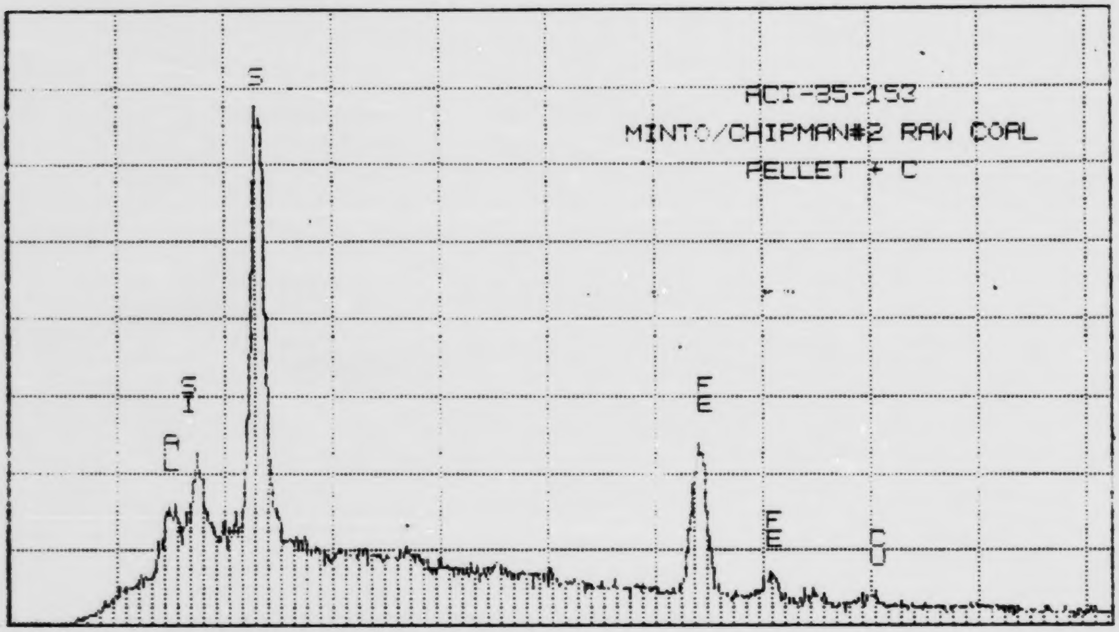

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0.000 VFS = 512 10.240

50 MATRIX: PHOTO#1006-04,EDX9

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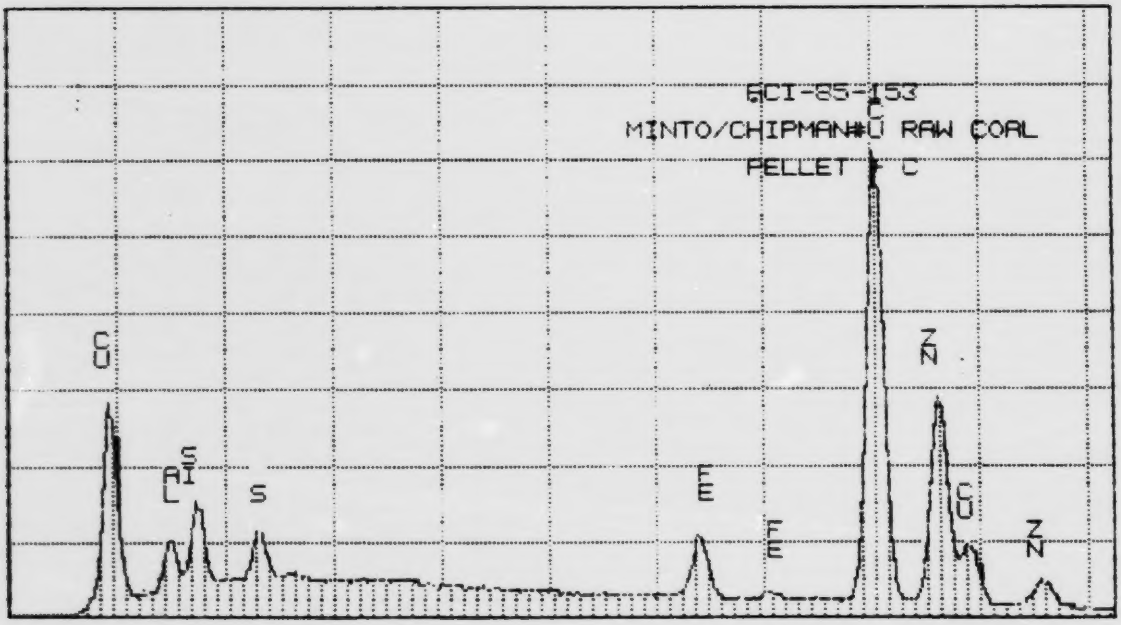

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ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:19

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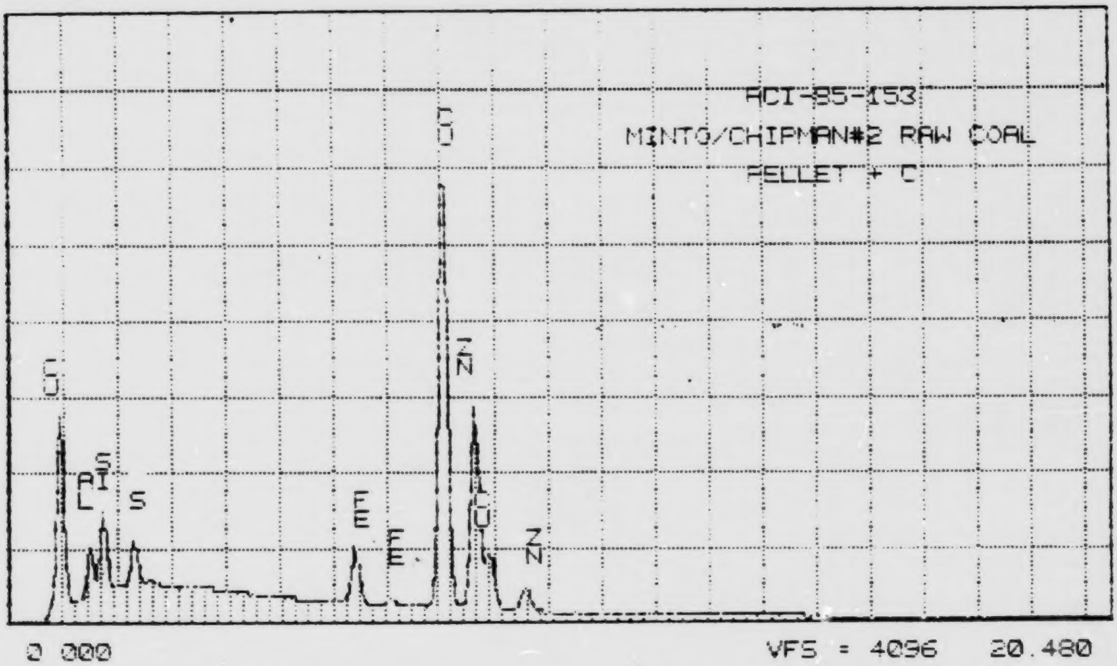


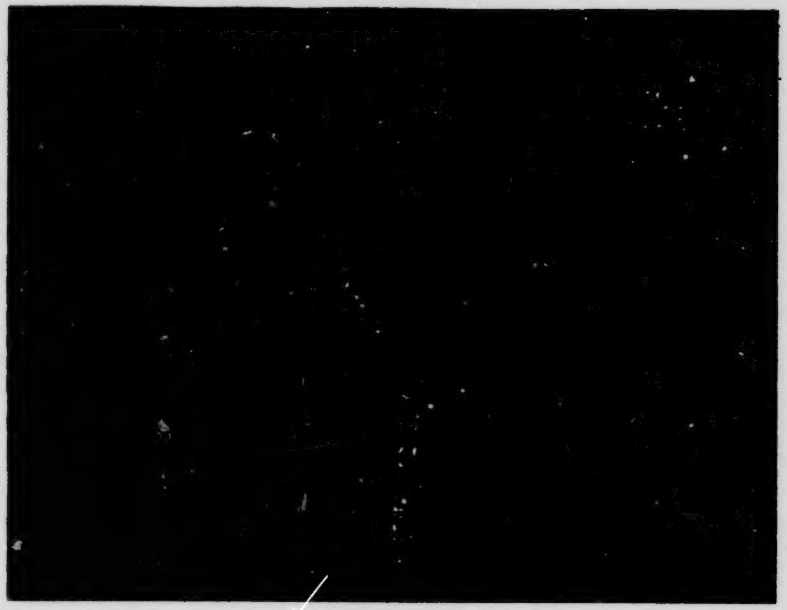
11

100 CONTAMINANT: PHOTO#1006-05,EDX10

PLATE 3

MINERAL ANALYSIS
Prince/Hub -1/2" subsample, hand-picked, bright fraction

Photo No.	Index No.	Description	Spectra No.
1	1120-02	Area View; 50x; BEI	
2	1120-04	Grain #1; 75x; BEI	1,2,3,4,5,6,7
3	1124-05	Grain #2; 100x; BEI	8,9,10,11,12
4	1125-01	Grain #3; 150x; BEI	13,14,15,16,17 18,19,20,21,22



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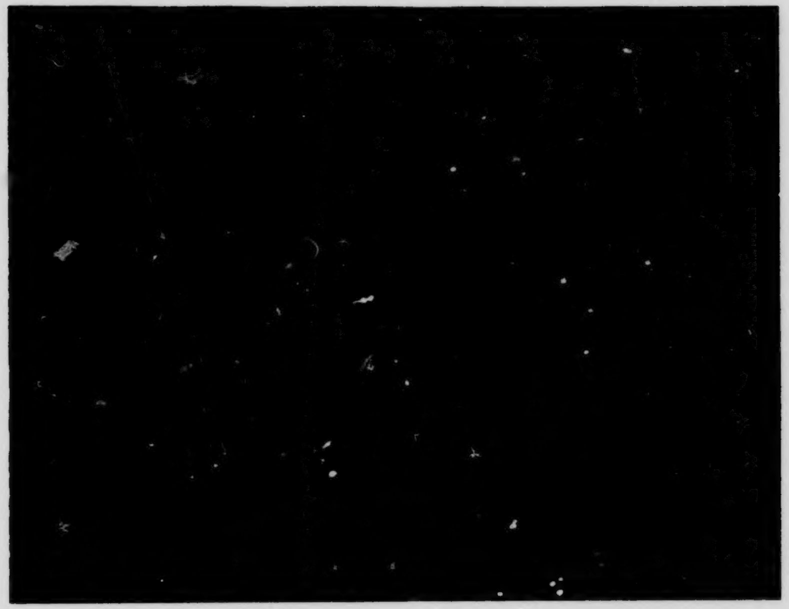
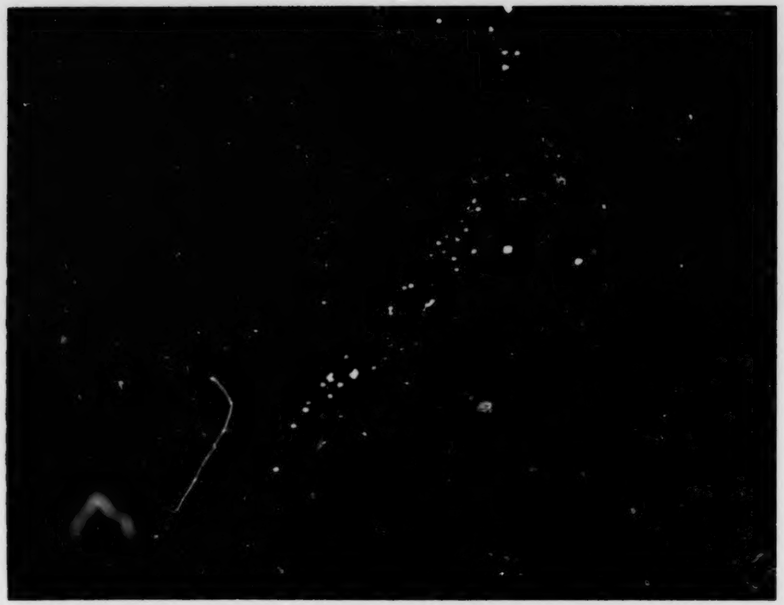
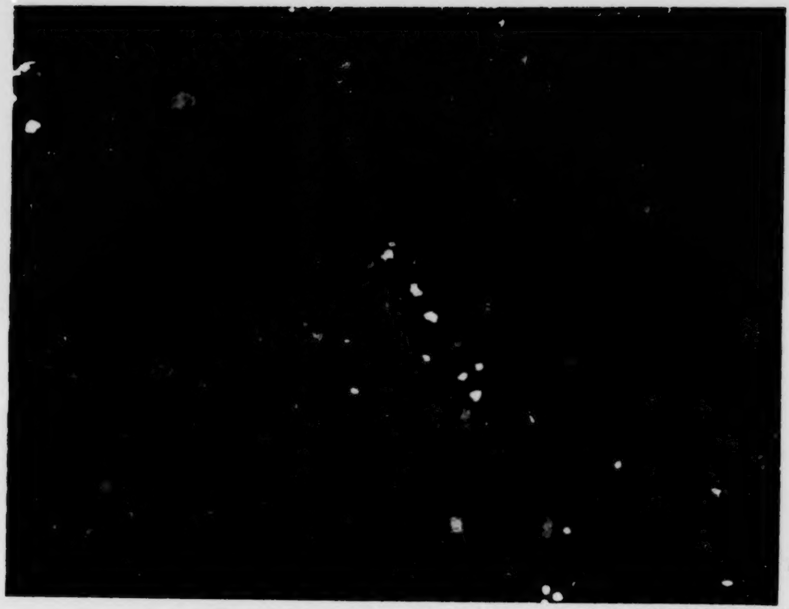


2



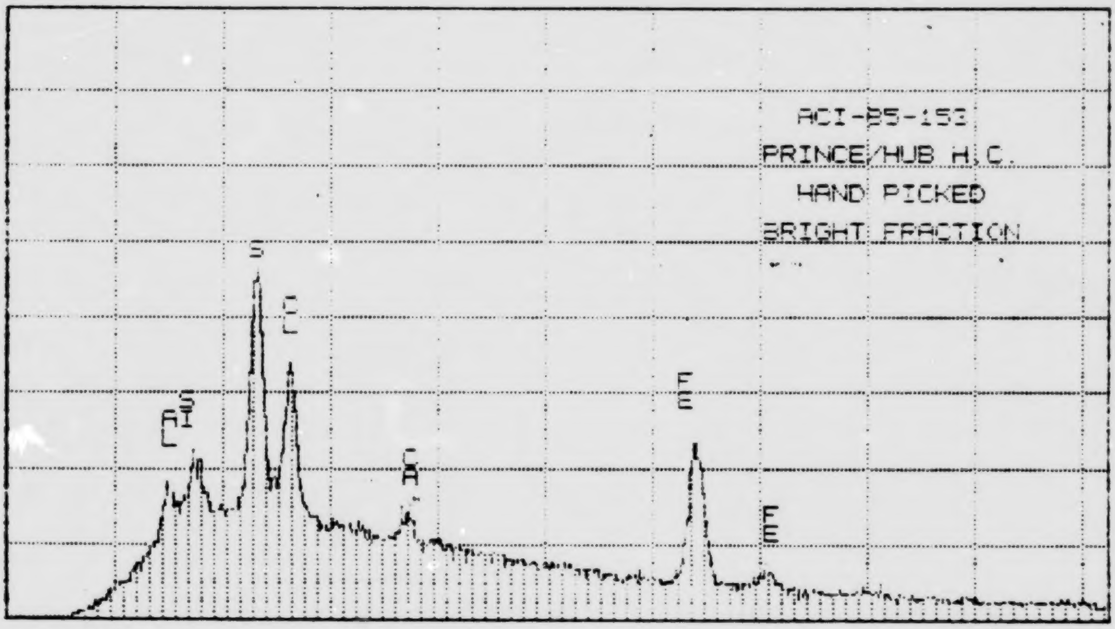
3



4

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 12:02

Cursor: 0.000keV = 0



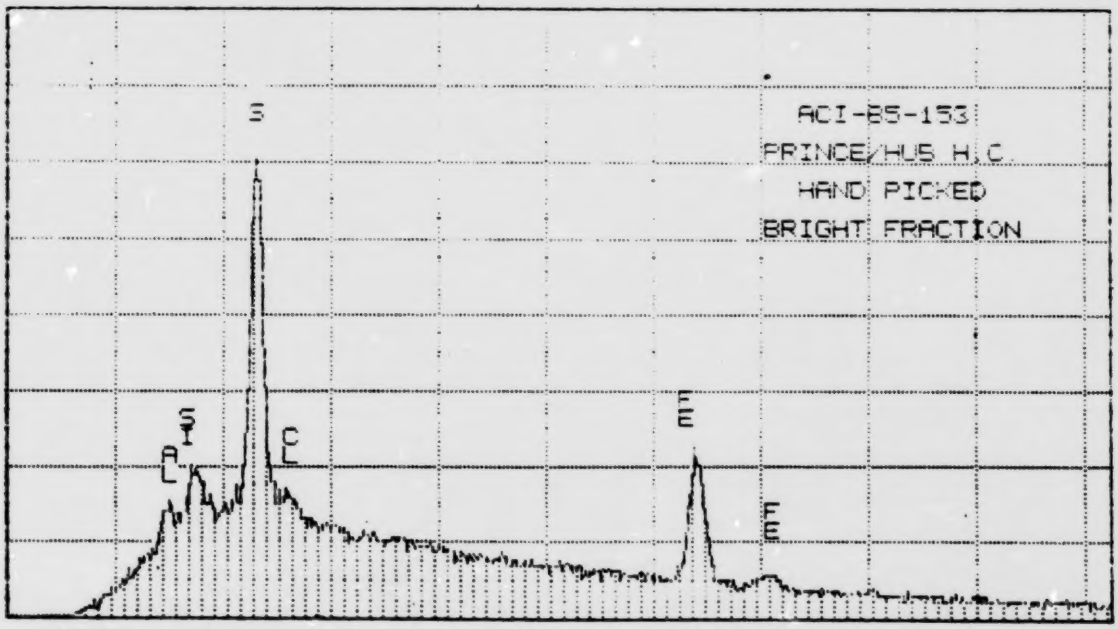
1

0.000 VFS = 1024 10.240

50 MATRIX LT: PHOTO#1120-04.EDX1

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 12:04

Cursor: 0.000keV = 0

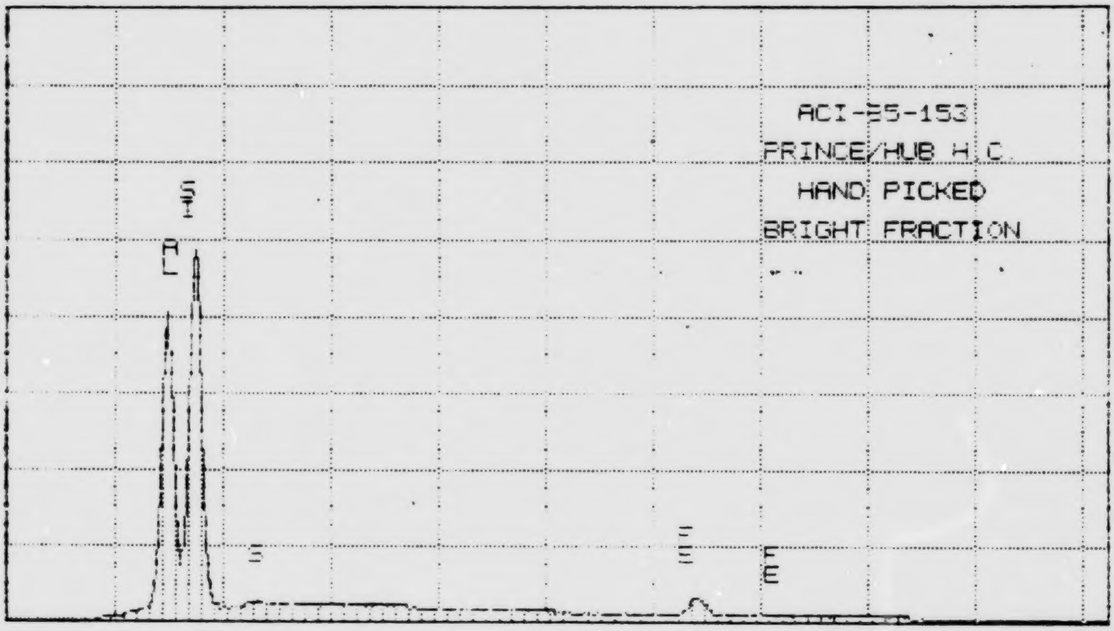


2

0.000 VFS = 1024 10.240

50 MATRIX DK: PHOTO#1120-04.EDX2

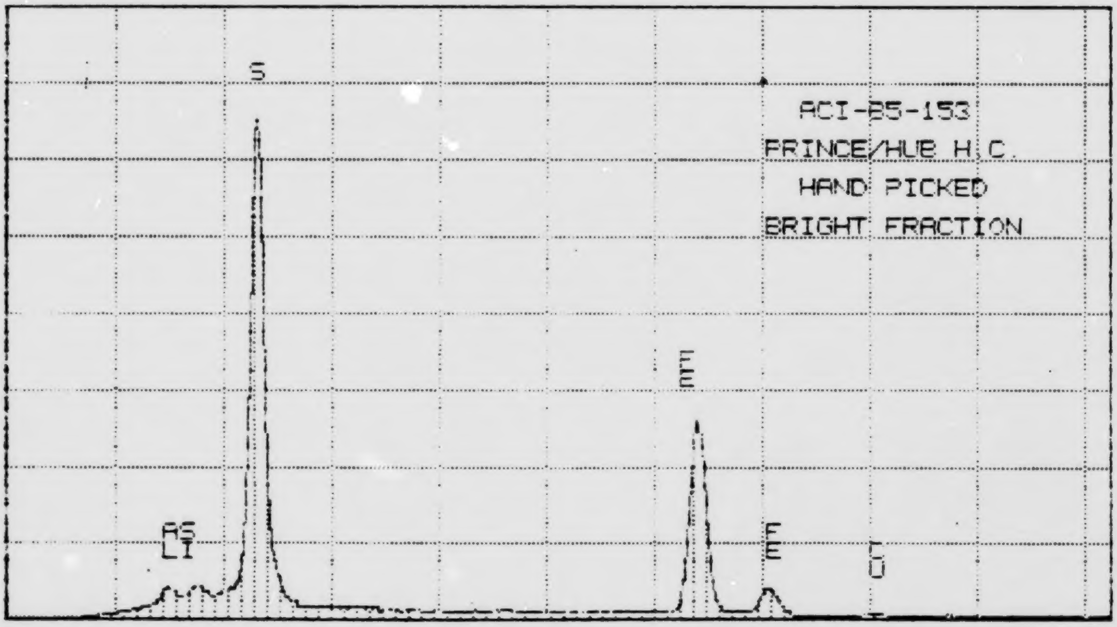
ATLANTIC COAL INSTITUTE TUE 25-NOV-86 12:06
Cursor: 0.000keV = 0



0.000 VFS = 8192 10.240
50 MINERAL:**K** PHOTO#1120-04.EDX3

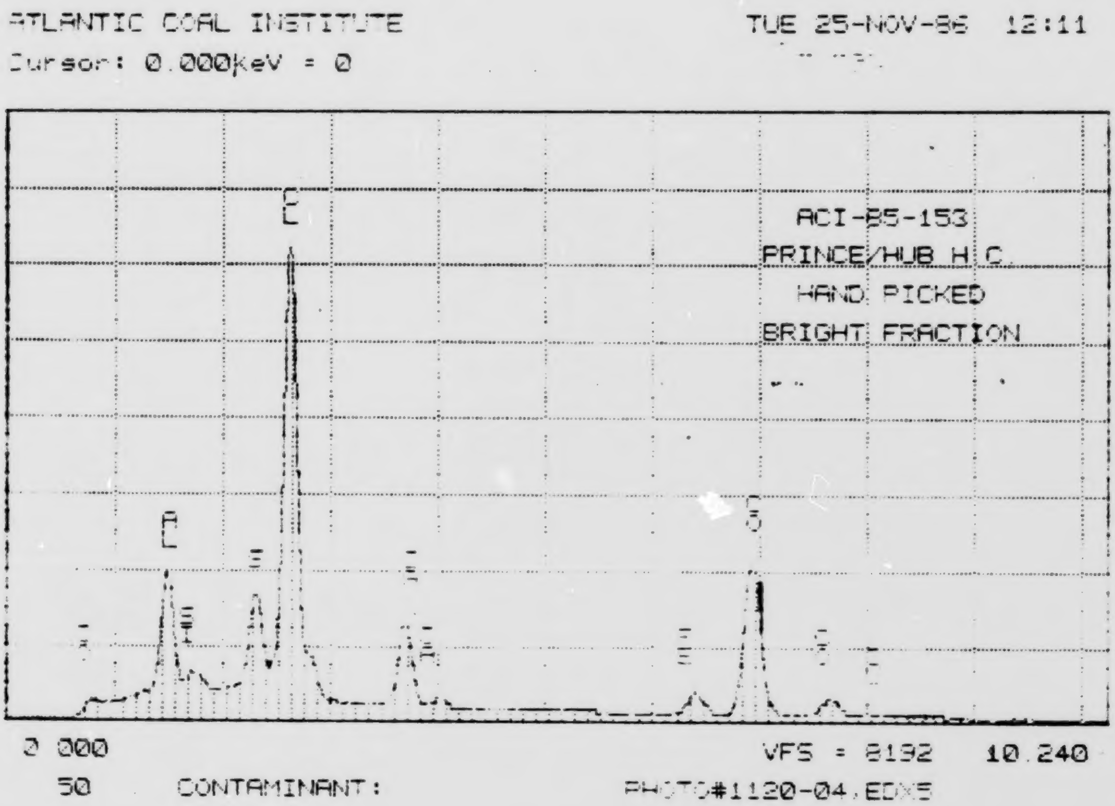
3

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 12:09
Cursor: 0.000keV = 0



0.000 VFS = 16384 10.240
50 MINERAL:**P** PHOTO#1120-04.EDX4

4



ATLANTIC COAL INSTITUTE
Cursor: 0.000keV = 0

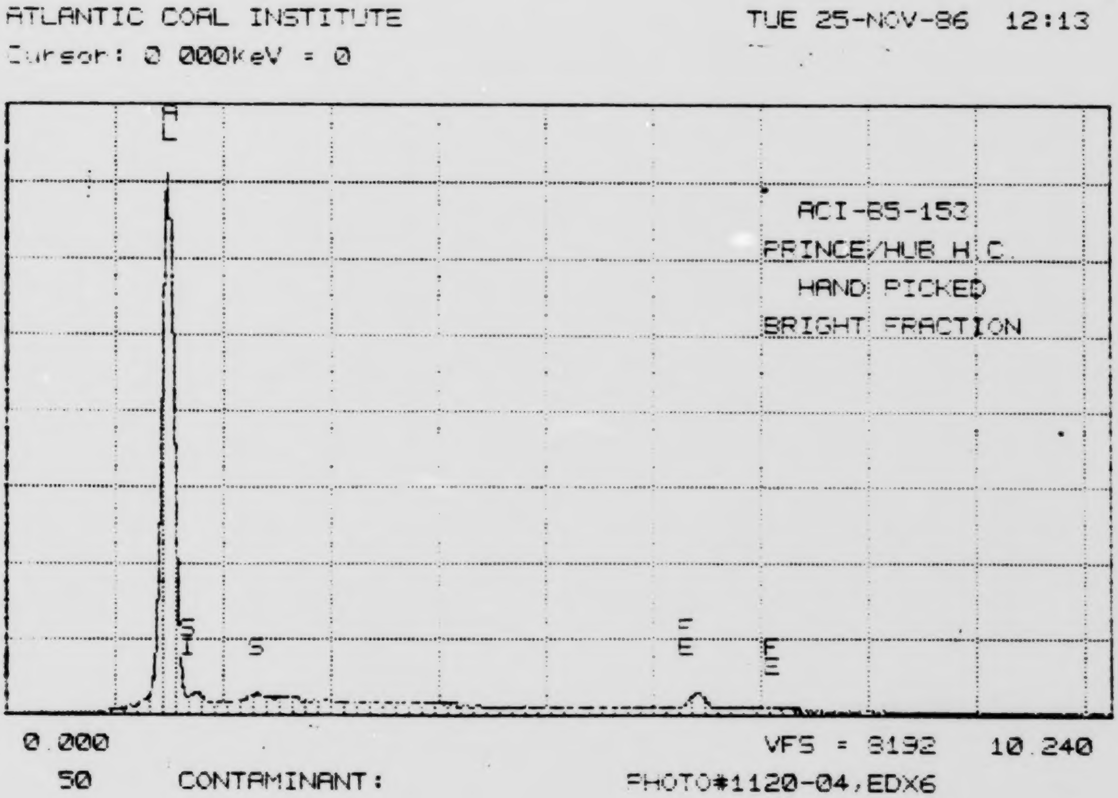
TUE 25-NOV-86 12:11

ACI-85-153
PRINCE/HUB H C.
HAND PICKED
BRIGHT FRACTION

0 000
50 CONTAMINANT:

VFS = 8192 10.240
PHOTO#1120-04,EDX5

5



ATLANTIC COAL INSTITUTE
Cursor: 0 000keV = 0

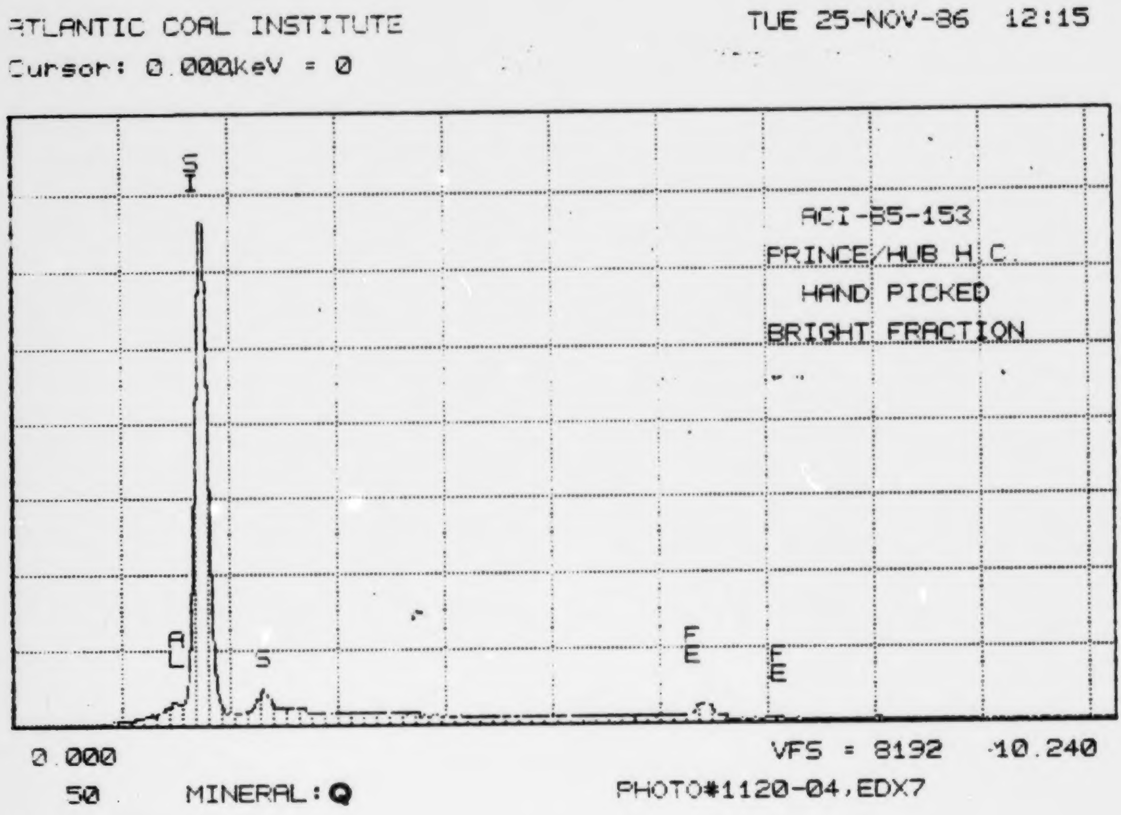
TUE 25-NOV-86 12:13

ACI-85-153
PRINCE/HUB H C.
HAND PICKED
BRIGHT FRACTION

0.000
50 CONTAMINANT:

VFS = 8192 10.240
PHOTO#1120-04,EDX6

6



ATLANTIC COAL INSTITUTE TUE 25-NOV-86 12:15

Cursor: 0.000keV = 0

ACI-85-153

PRINCE/HUB H.C.

HAND PICKED

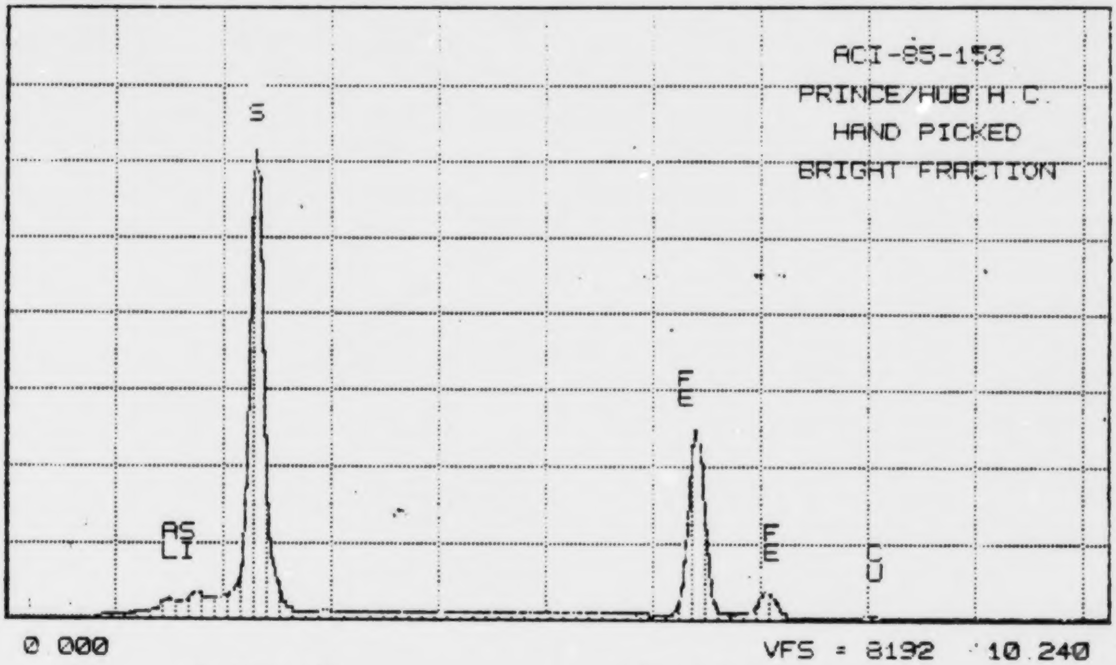
BRIGHT FRACTION

0.000 VFS = 8192 10.240

50 MINERAL: Q PHOTO#1120-04, EDX7

7

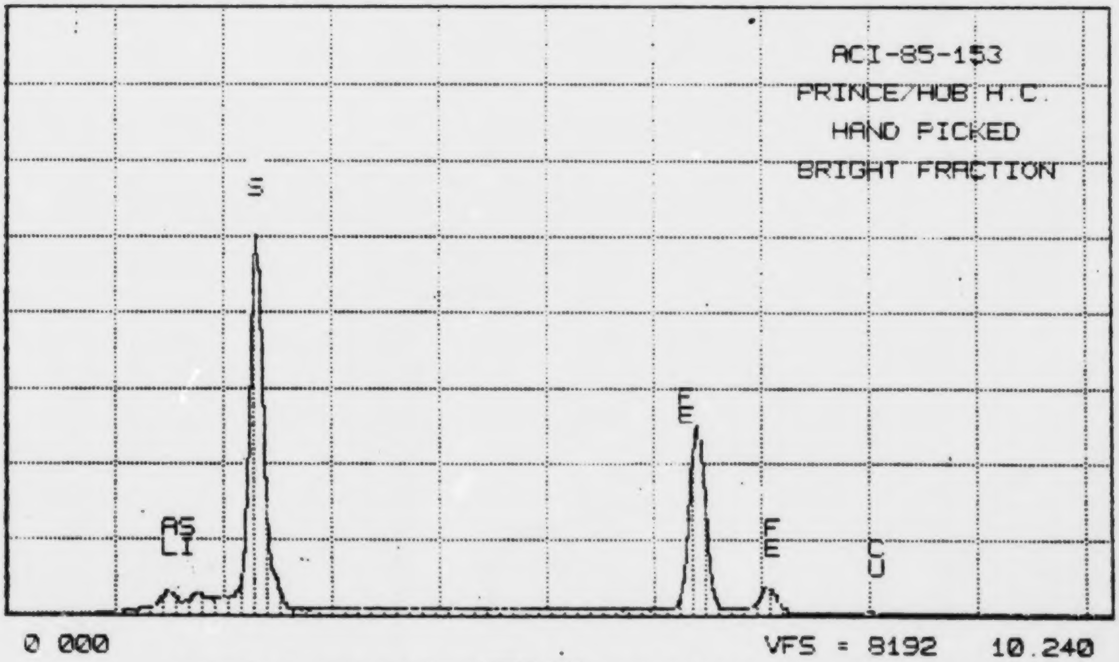
ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:42
Cursor: 0.000keV = 0



8

50 MINERAL: **P** PHOTO#1124-05,EDX1

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:49
Cursor: 0.000keV = 0

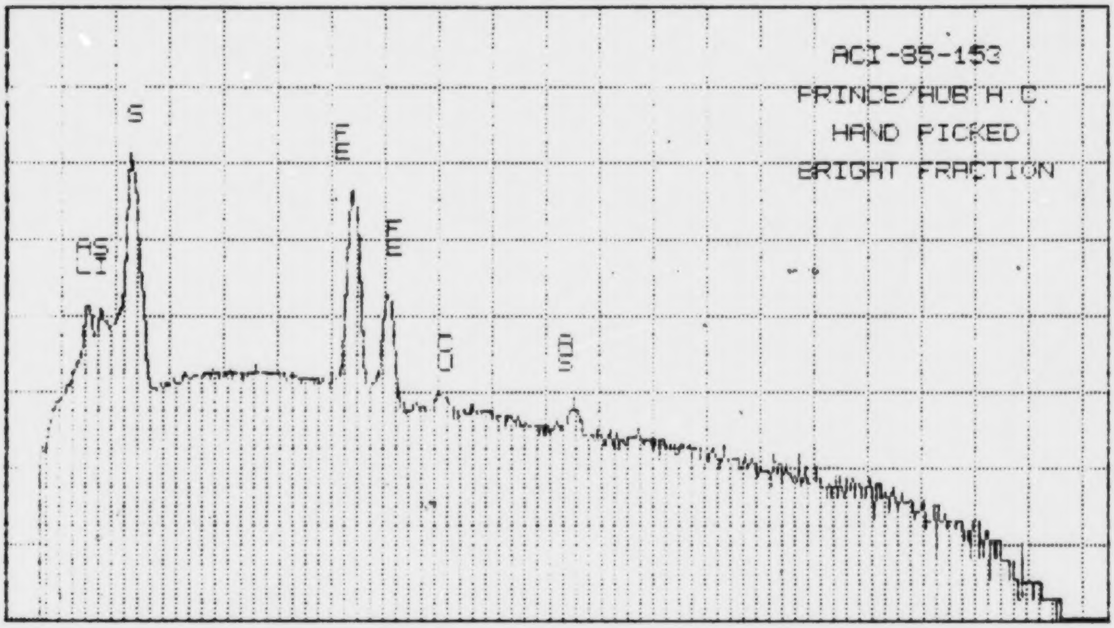


9

50 MINERAL: **P + As** (see EDX 10) PHOTO#1124-05,EDX2

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 16:14

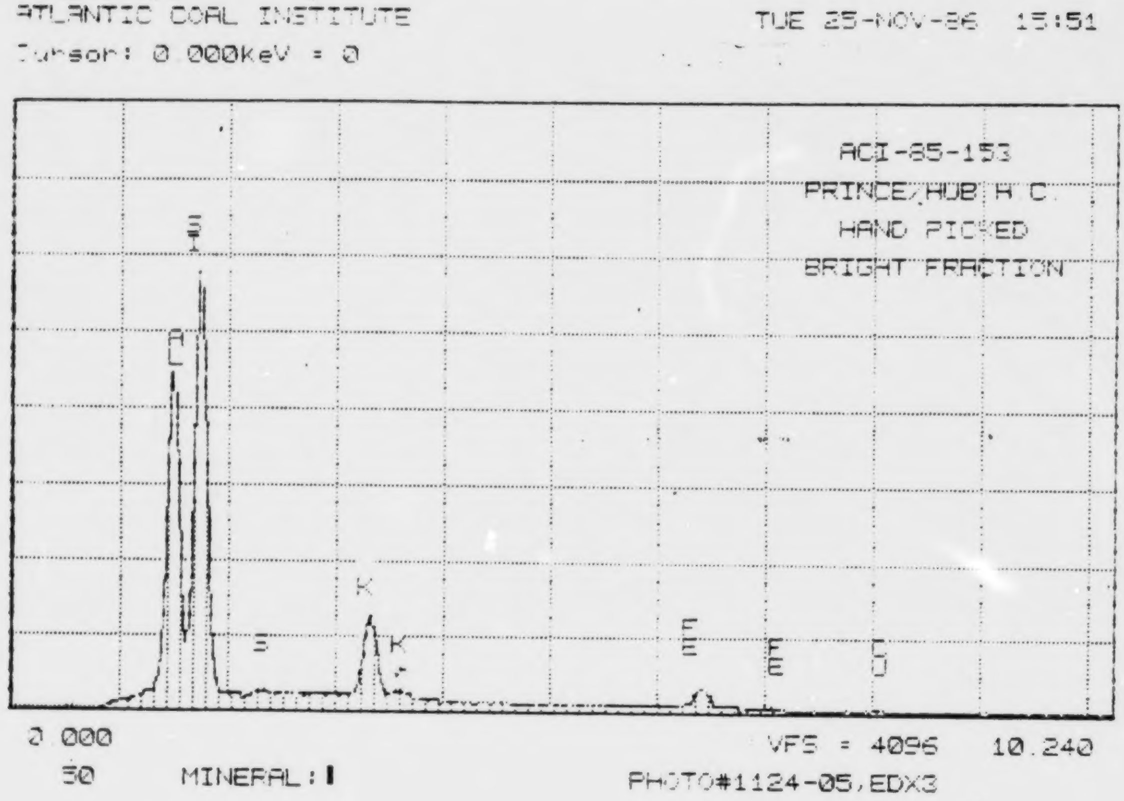
Cursor: 0.000keV = 0



10

0 200 VFS = LOG 1 20.480

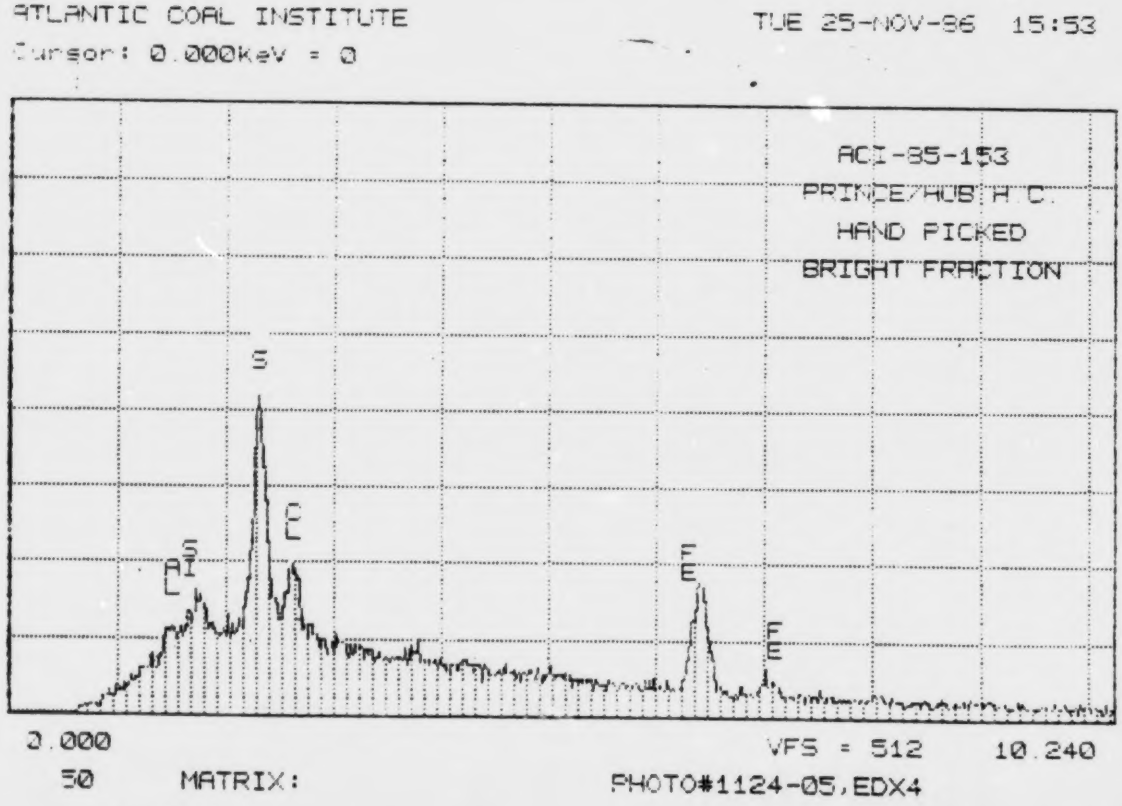
50 MINERAL: **P + As** PHOTO#1124-05,EDX2


ATLANTIC COAL INSTITUTE
TUE 25-NOV-86 15:51
Cursor: 0.000keV = 0

ACI-85-153
PRINCE/HUB H.C.
HAND PICKED
BRIGHT FRACTION

0.000
VFS = 4096
10.240
50 MINERAL:
PHOTO#1124-05,EDX3

11

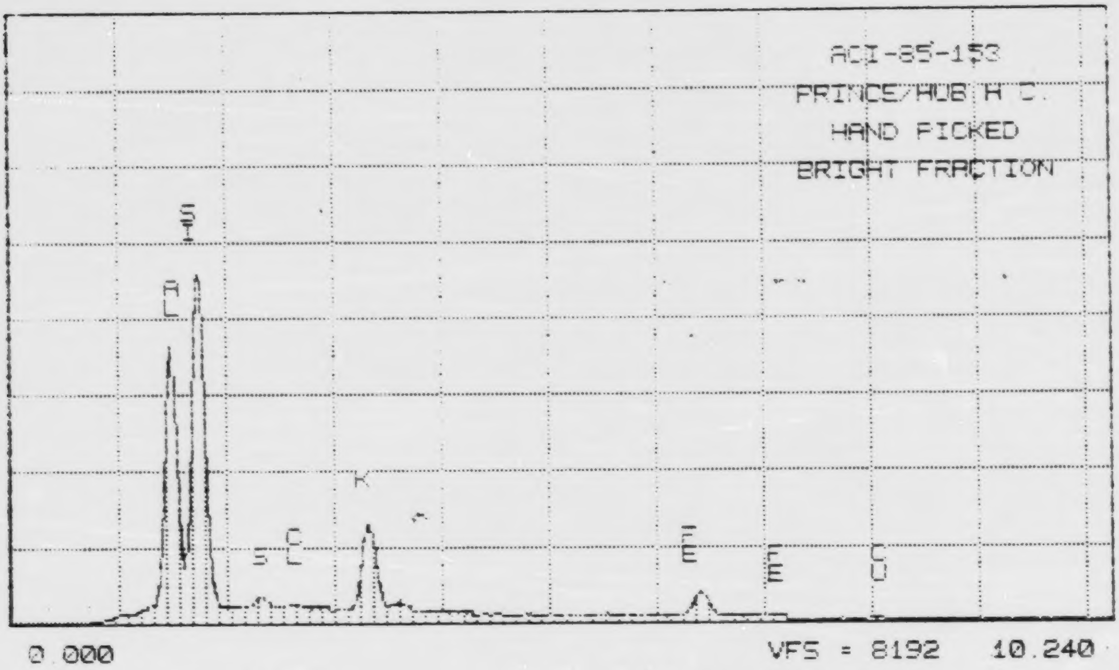

ATLANTIC COAL INSTITUTE
TUE 25-NOV-86 15:53
Cursor: 0.000keV = 0

ACI-85-153
PRINCE/HUB H.C.
HAND PICKED
BRIGHT FRACTION

0.000
VFS = 512
10.240
50 MATRIX:
PHOTO#1124-05,EDX4

12

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:23
Cursor: 0.000keV = 0

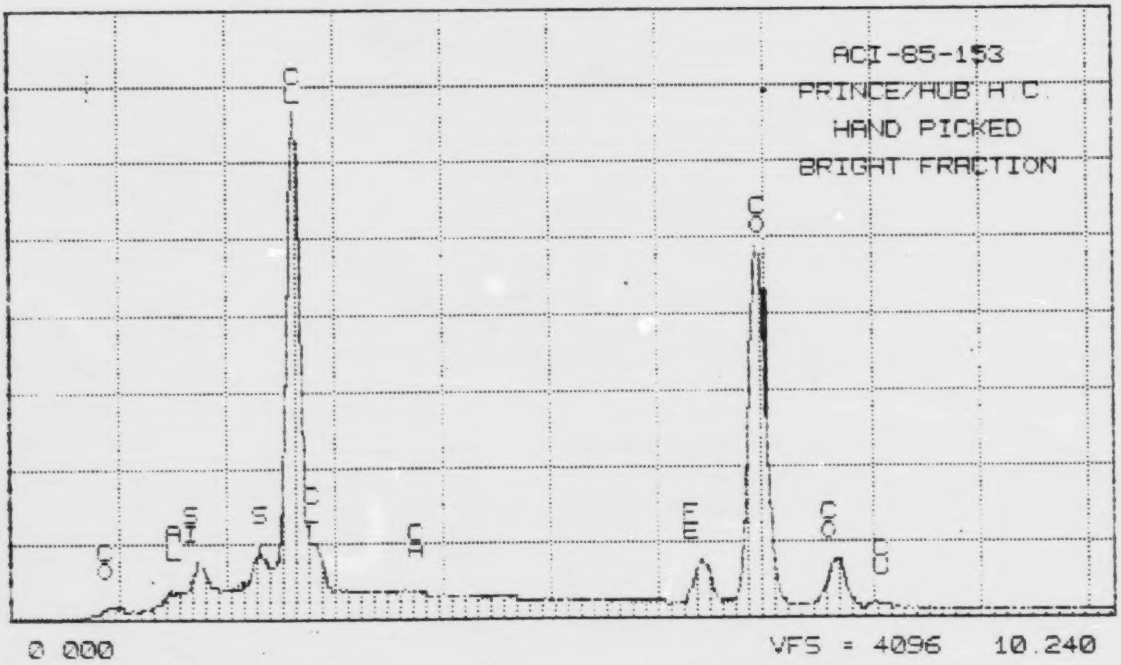


50 MINERAL:

PHOTO#1125-01,EDX1

13

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:25
Cursor: 0.000keV = 0

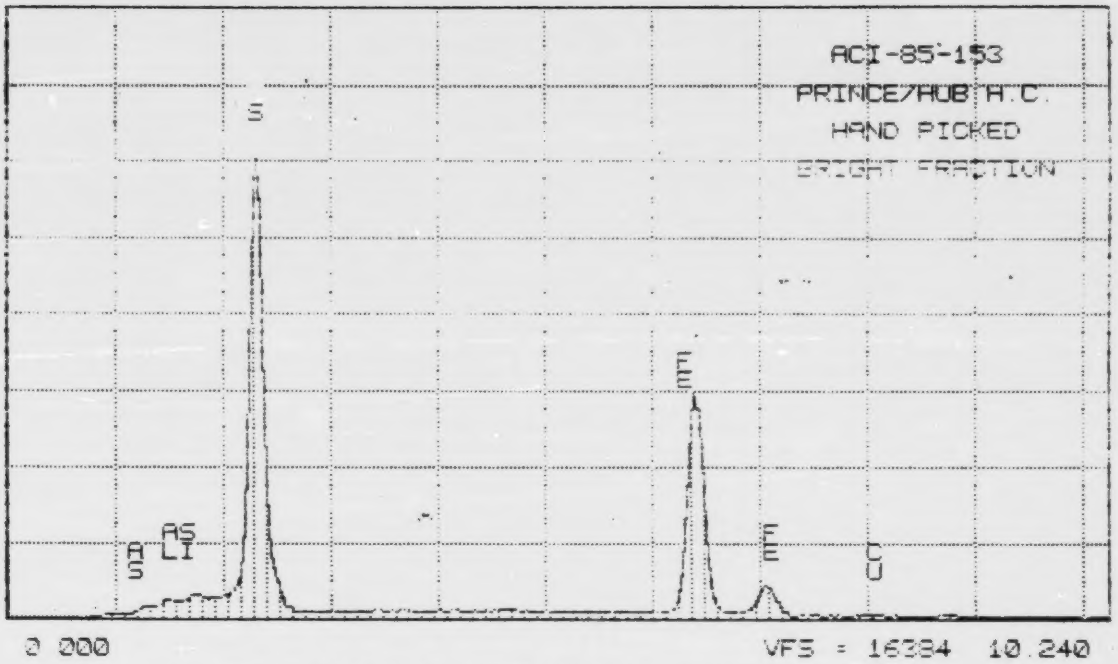


50 CONTAMINANT:

PHOTO#1125-01,EDX2

14

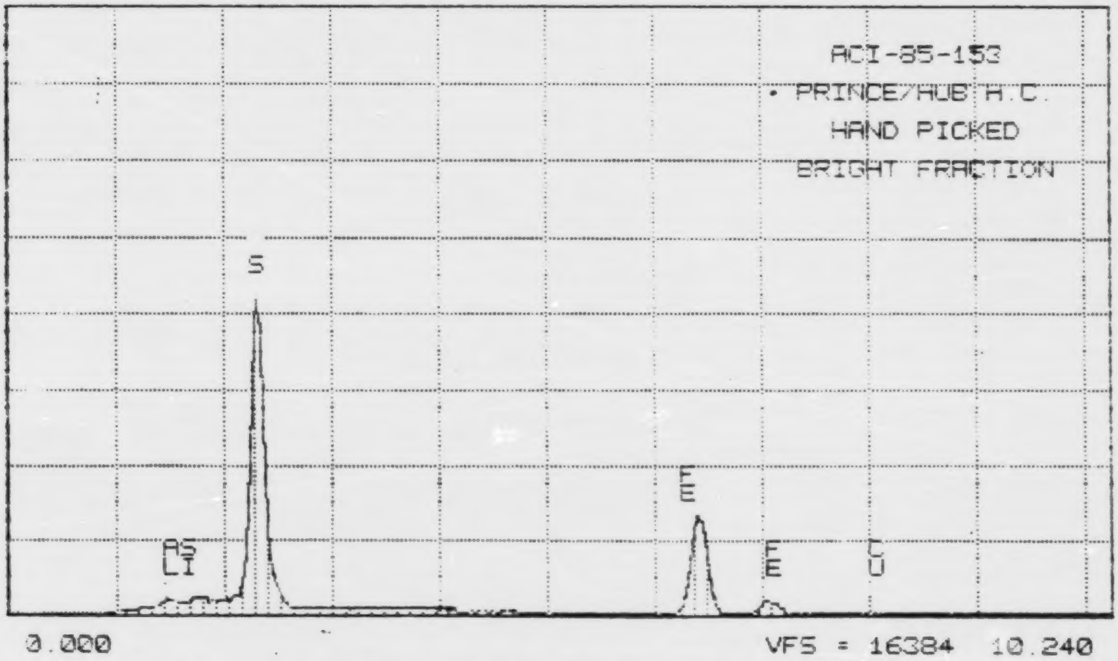
ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:28
Cursor: 0.000keV = 0



15

50 MINERAL: **P + As** (see EDX 17) PHOTO#1125-01,EDX3

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:30
Cursor: 0.000keV = 0

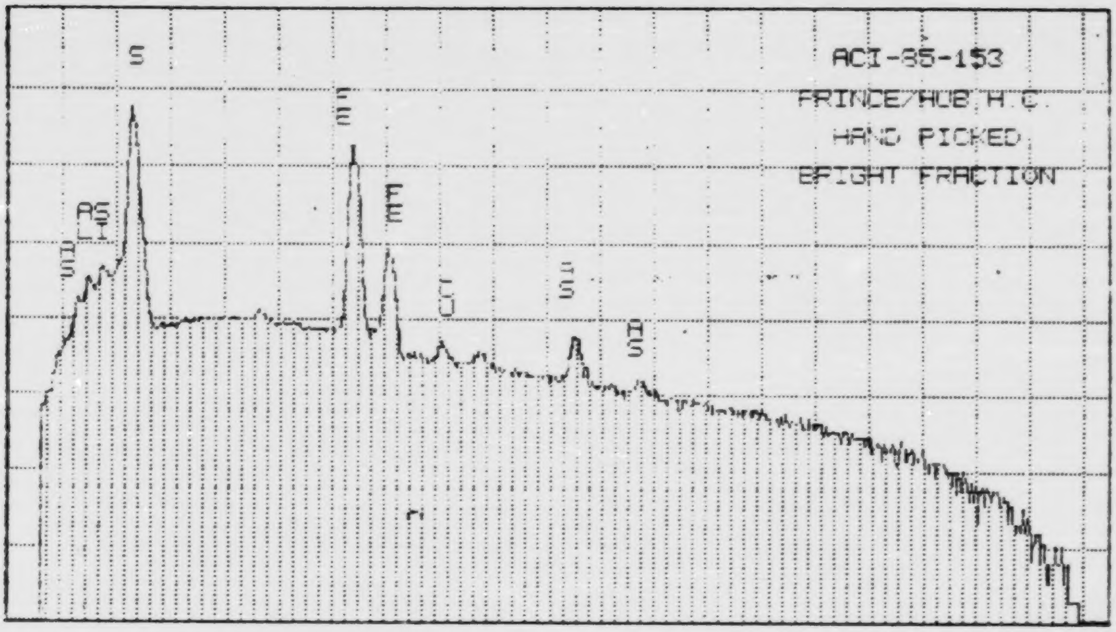


16

50 MINERAL: **P** (see EDX 18) PHOTO#1125-01 EDX4

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 16:00

Cursor: 0.000keV = 0



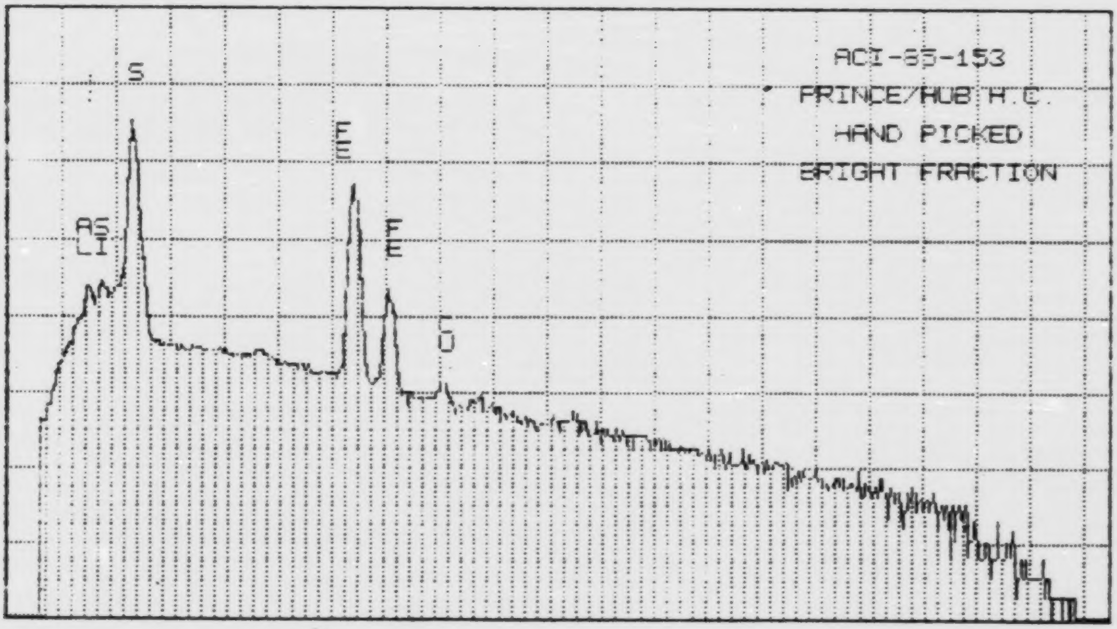
17

0.000 VFS = LOG 1 20.480

50 MINERAL: **P + As** PHOTO#1125-01,EDX3

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 16:05

Cursor: 0.000keV = 0



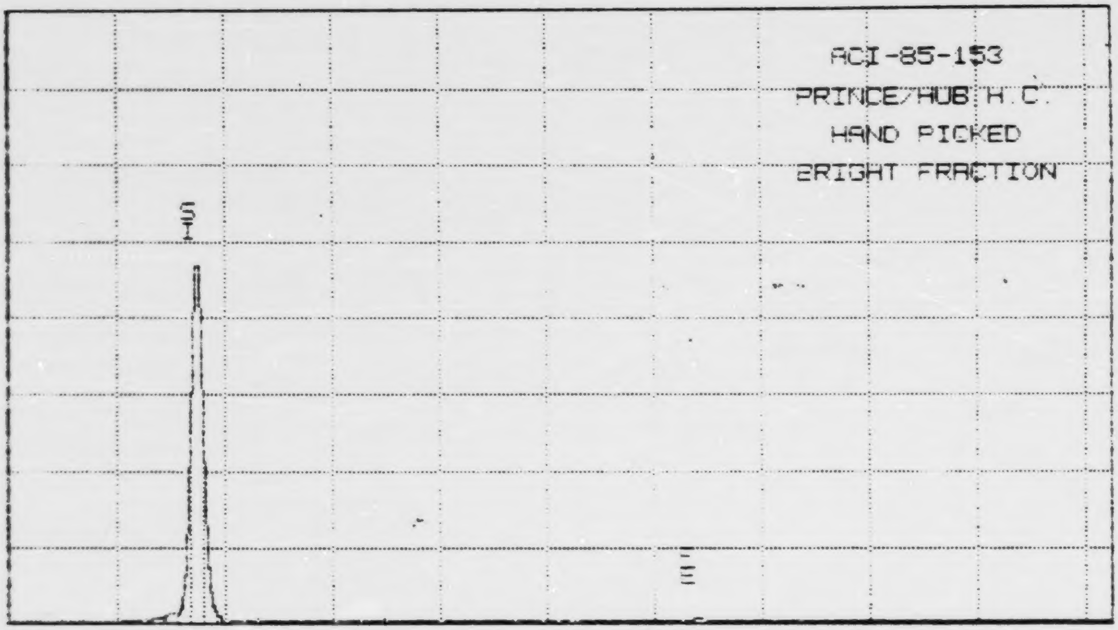
18

0.000 VFS = LOG 1 20.480

50 MINERAL: **P** PHOTO#1125-01,EDX4

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:32

Cursor: 0.000keV = 0



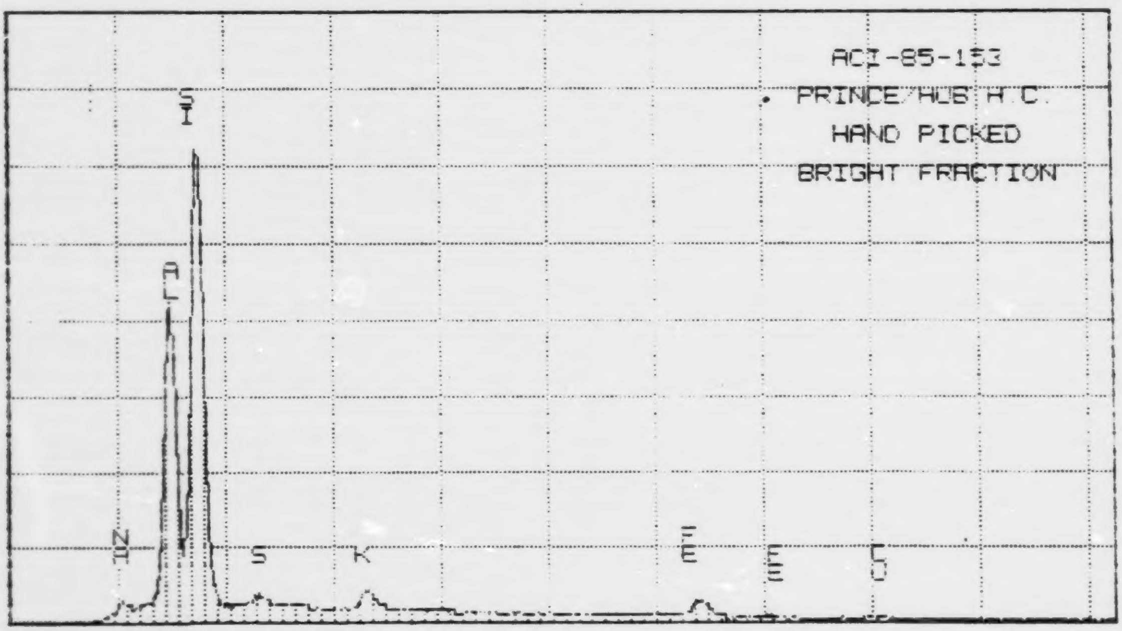
19

0.000 VFS = 16384 10.240

50 MINERAL: Q PHOTO#1125-01.EDX5

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:34

Cursor: 0.000keV = 0

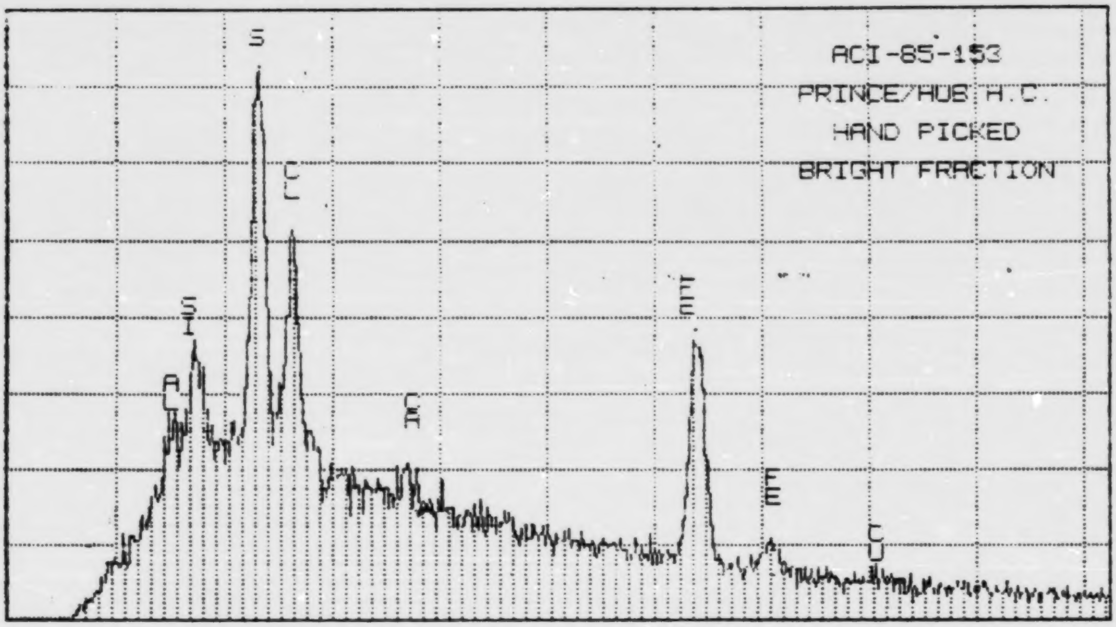


20

0.000 VFS = 4096 10.240

50 MINERAL: I? PHOTO#1125-01.EDX6

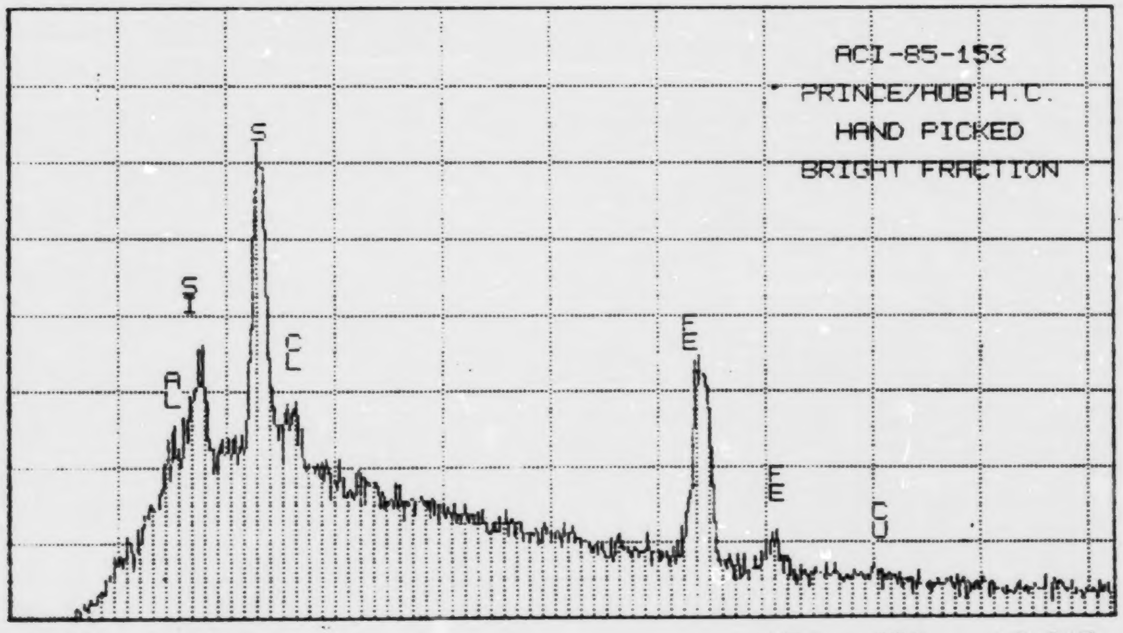
ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:36
Cursor: 0.000keV = 0



21

0.000 VFS = 256 10.240
50 MATRIX LT: PHOTO#1125-01,EDX7

ATLANTIC COAL INSTITUTE TUE 25-NOV-86 15:38
Cursor: 0.000keV = 0



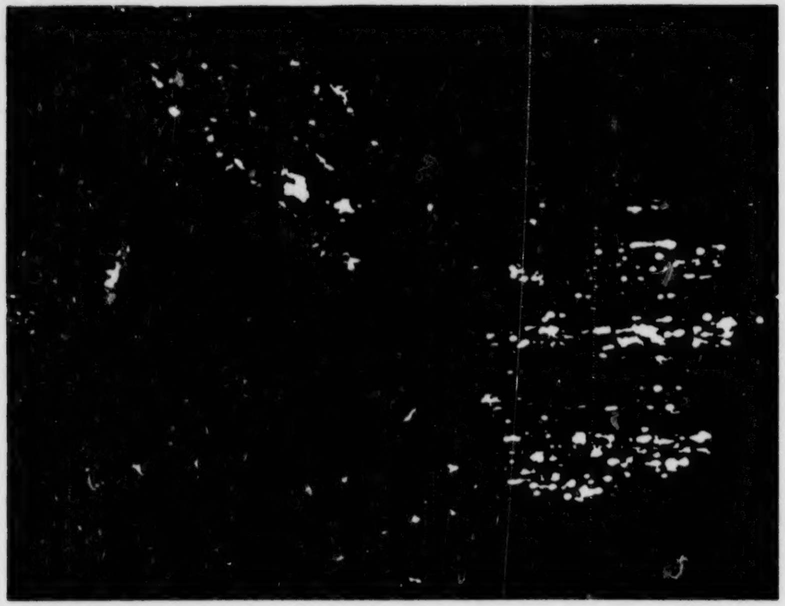
22

0.000 VFS = 256 10.240
50 MATRIX DK: PHOTO#1125-01,EDX8

PLATE 4

MINERAL ANALYSIS
Prince/Hub -1/2" subsample, hand-picked, bright banded fraction

Photo No.	Index No.	Description	Spectra No.
1	1119-02	Area View; 50x; BEI	
2	1119-03	Grain #1; 100x; BEI	1,2,3,4
3	1119-04	Grain #2; 100x; BEI	5,6
4	1119-05	Grain #3; 150x; BEI	7,8,9,10



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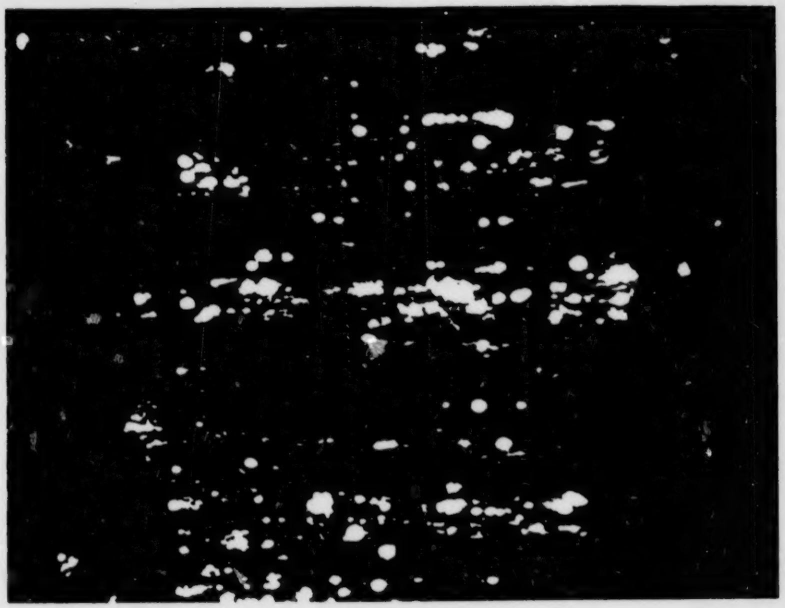

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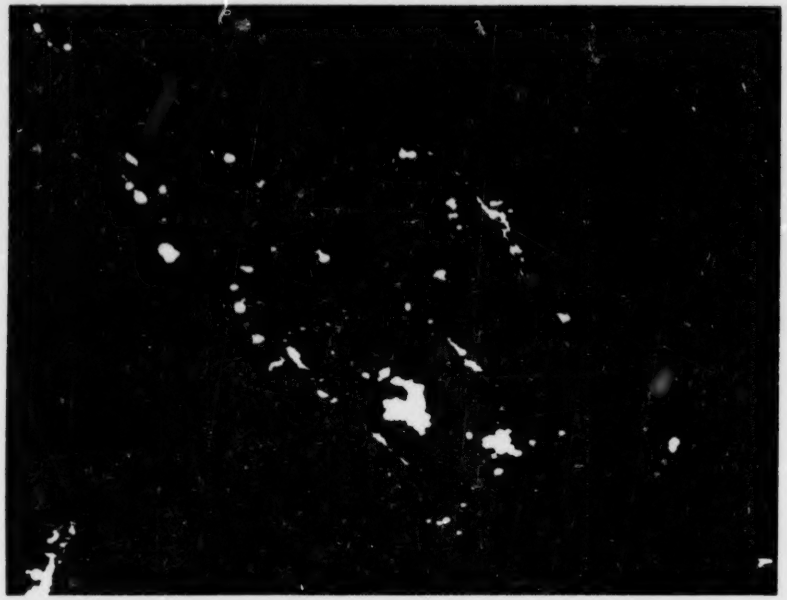
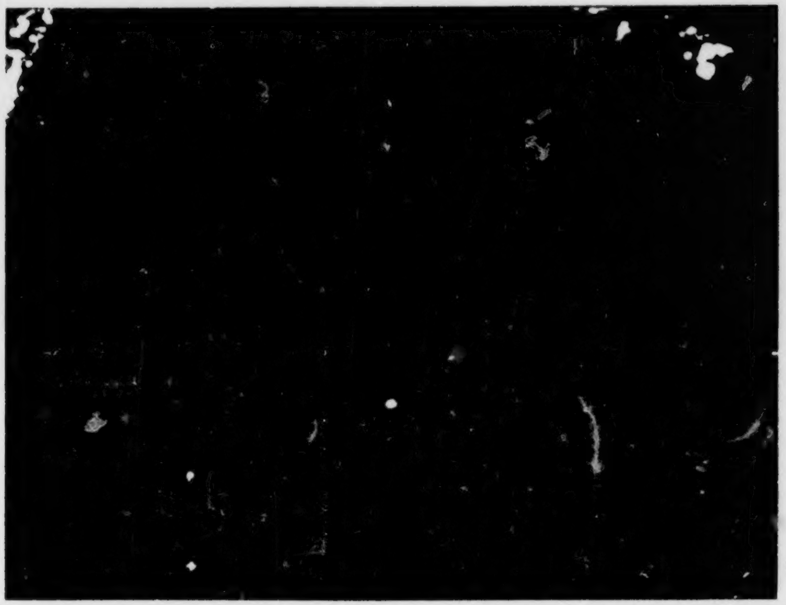


3



4

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:41
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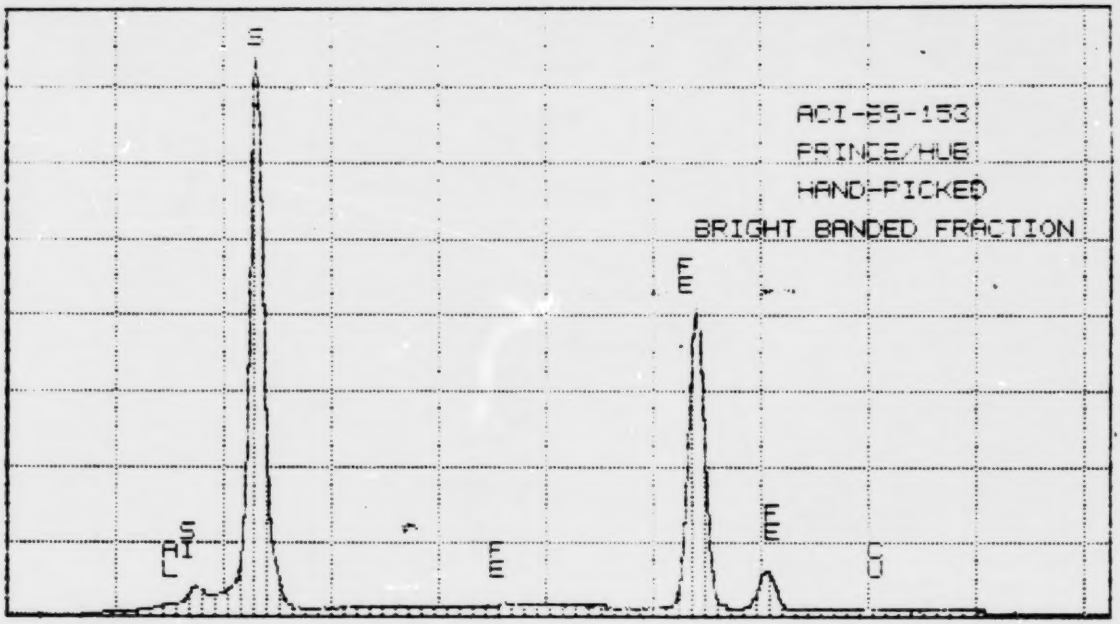
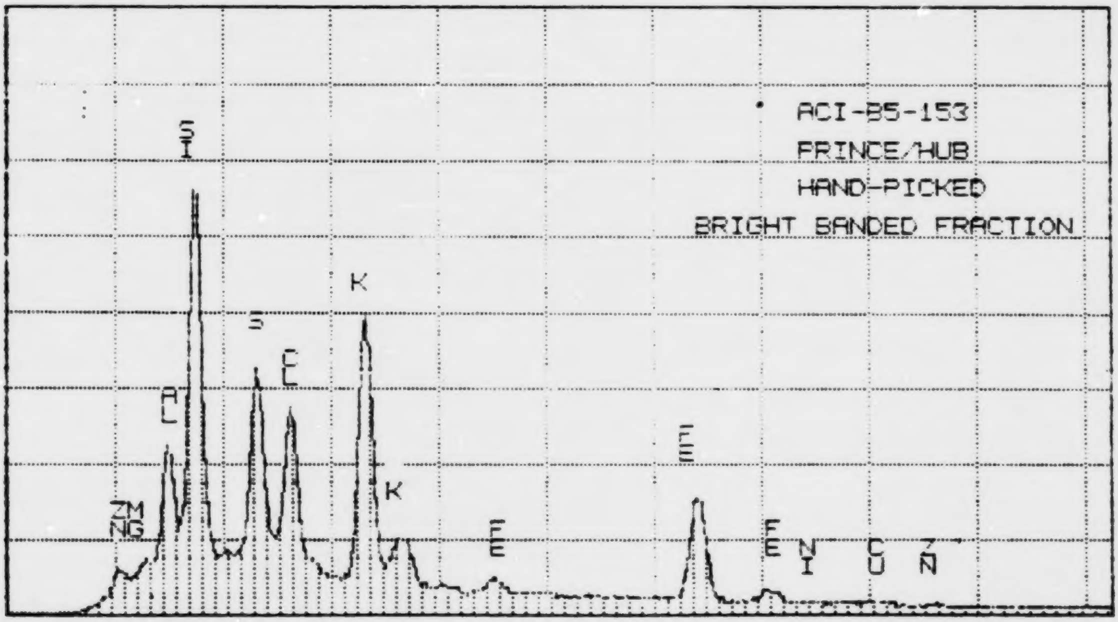


0.000 VFS = 16384 10.240
50 MINERAL:**P** PHOTO#1119-03,EDX1

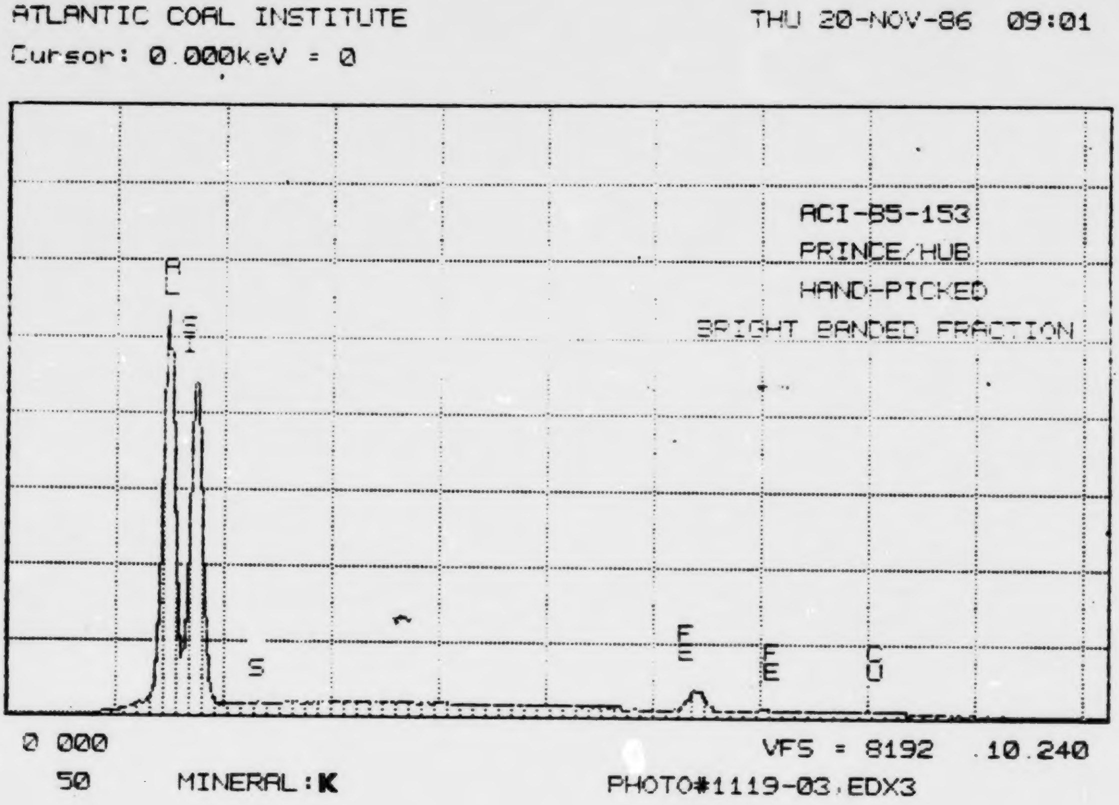
1

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:45
Cursor: 0.000keV = 0



0.000 VFS = 4096 10.240
50 CONTAMINANT: PHOTO#1119-03,EDX2

2



ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:01

Cursor: 0.000keV = 0

ACI-85-153

PRINCE/HUB

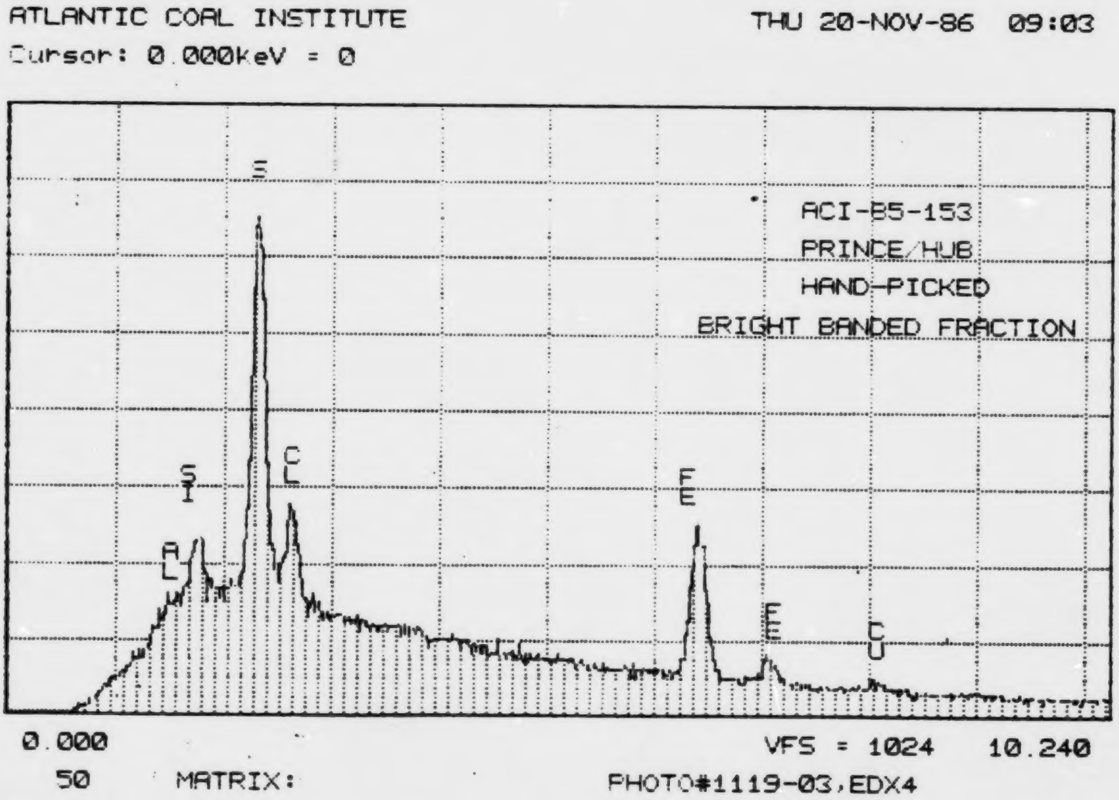
HAND-PICKED

BRIGHT BANDED FRACTION

0.000 VFS = 8192 10.240

50 MINERAL:**K** PHOTO#1119-03,EDX3

3



ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:03

Cursor: 0.000keV = 0

ACI-85-153

PRINCE/HUB

HAND-PICKED

BRIGHT BANDED FRACTION

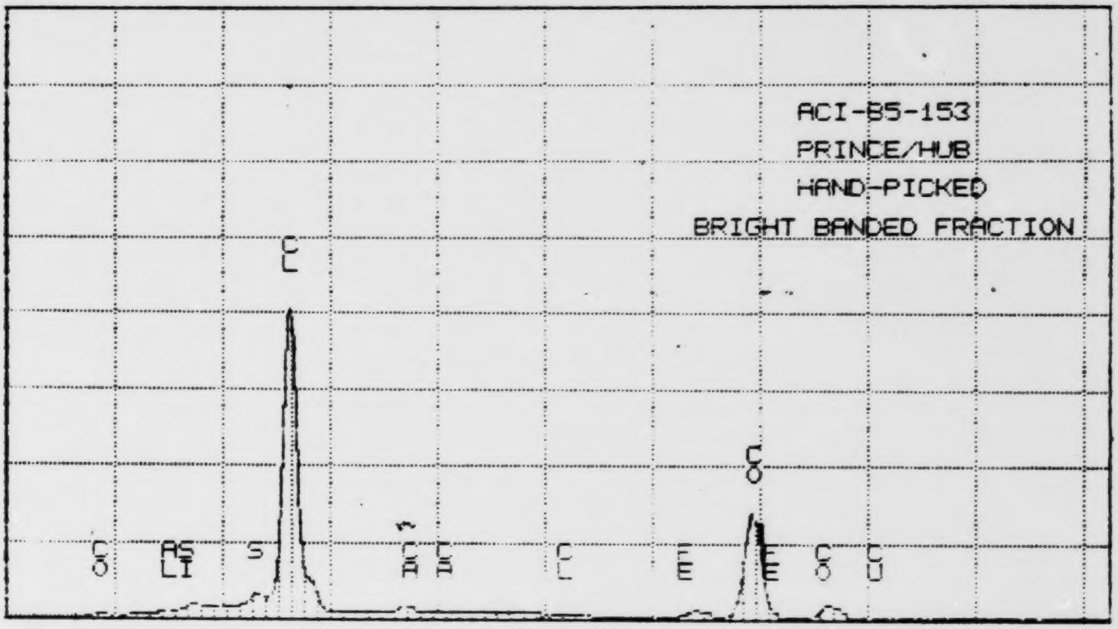
0.000 VFS = 1024 10.240

50 MATRIX: PHOTO#1119-03,EDX4

4

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:17

Cursor: 0.000keV = 0



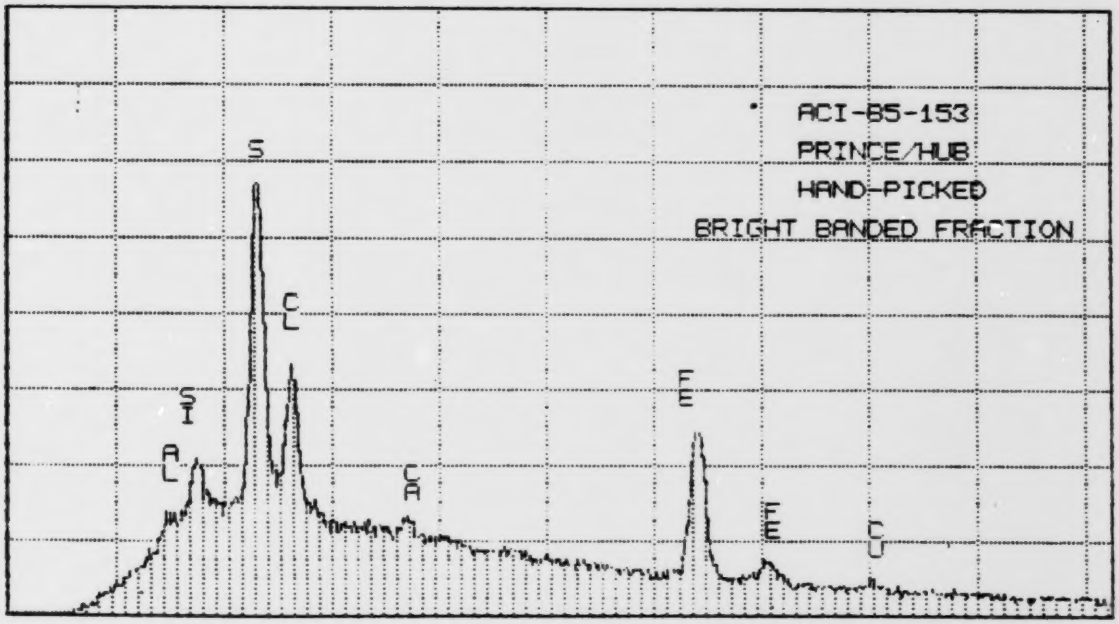
5

0.000 VFS = 32768 10.240

50 CONTAMINANT: PHOTO#1119-04,EDX1

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:20

Cursor: 0.000keV = 0



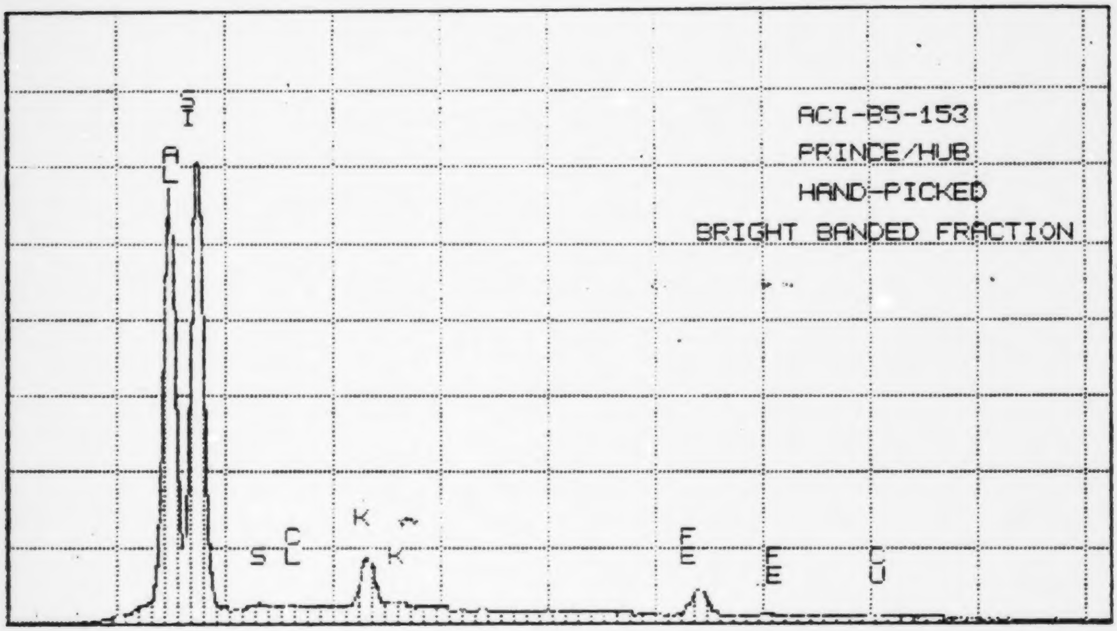
6

0.000 VFS = 1024 10.240

50 MATRIX: PHOTO#1119-04,EDX2

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:25

Cursor: 0.000keV = 0



ACI-85-153
PRINCE/HUB
HAND-PICKED
BRIGHT BANDED FRACTION

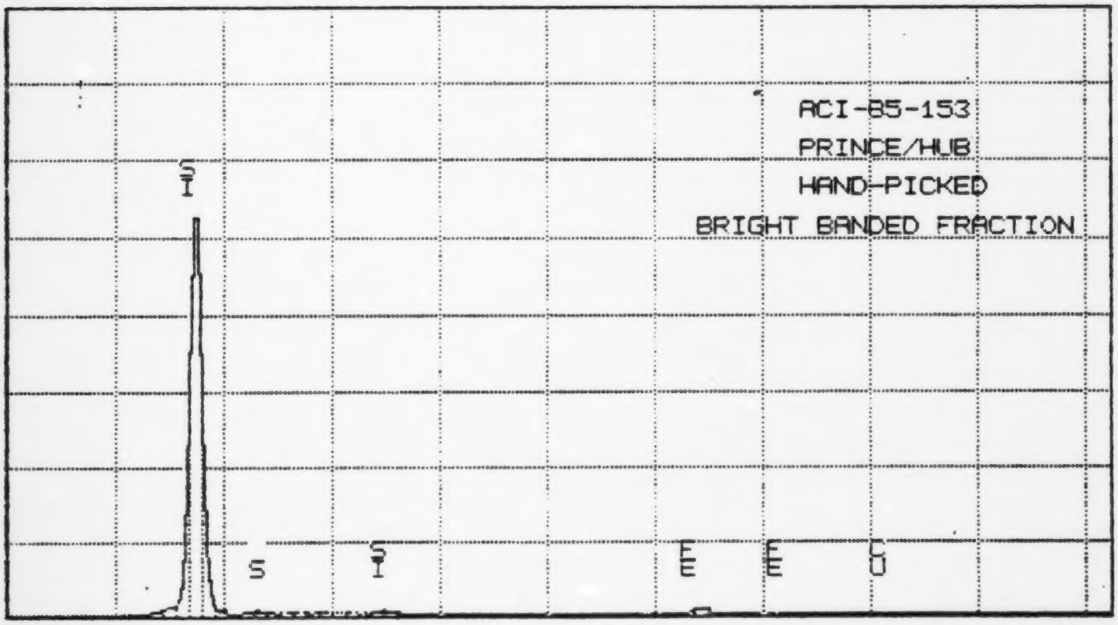
7

0.000 VFS = 8192 10.240

50 MINERAL:I PHOTO#1119-05,EDX1

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:27

Cursor: 0.000keV = 0



ACI-85-153
PRINCE/HUB
HAND-PICKED
BRIGHT BANDED FRACTION

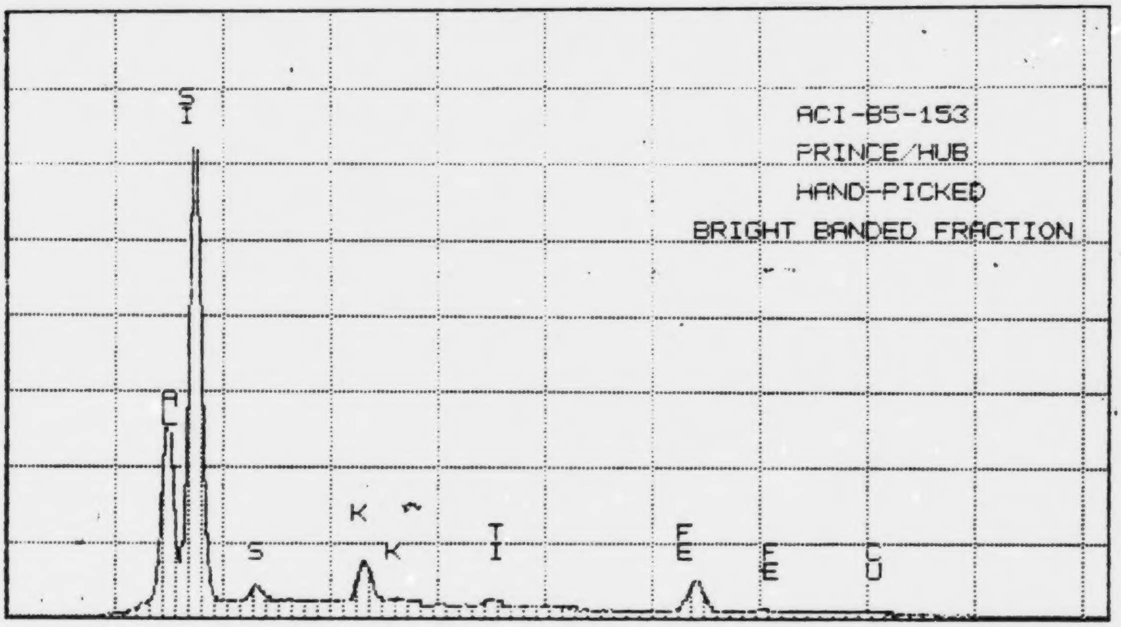
8

0.000 VFS = 32768 10.240

50 MINERAL:Q PHOTO#1119-05,EDX2

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:30

Cursor: 0.000keV = 0



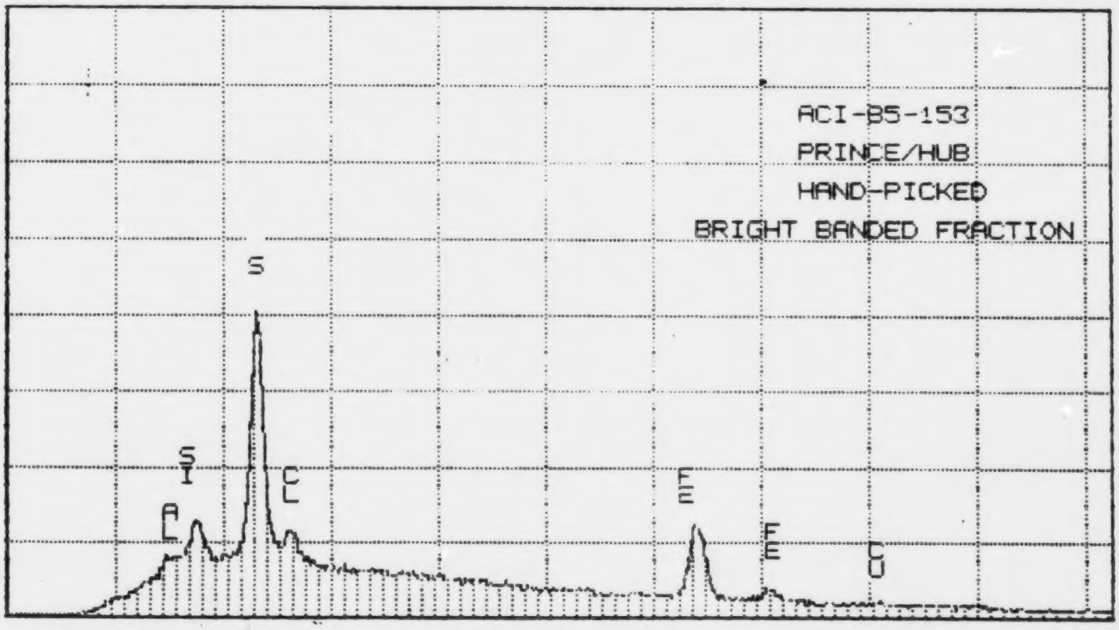
9

0 000 VFS = 8192 10.240

50 MINERAL: I +Ti PHOTO#1119-05,EDX3

ATLANTIC COAL INSTITUTE THU 20-NOV-86 09:34

Cursor: 0.000keV = 0



10

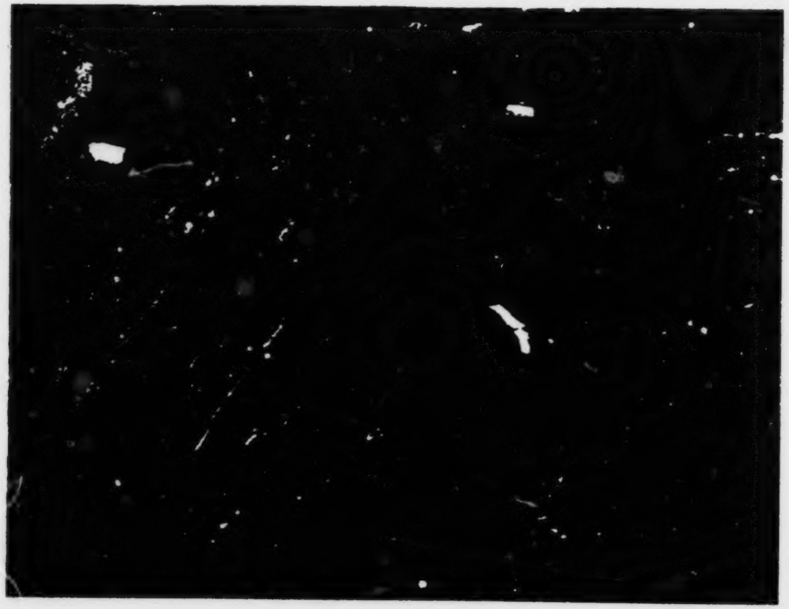
0.000 VFS = 2048 10.240

50 MATRIX: PHOTO#1119-05,EDX4

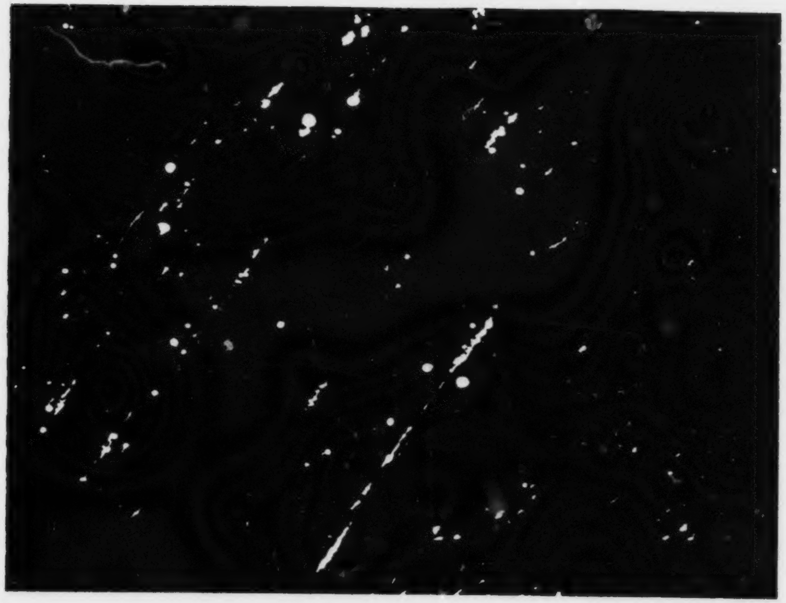
PLATE 5

MINERAL ANALYSIS
Prince/Hub -1/2" subsample, hand-picked, dull banded fraction

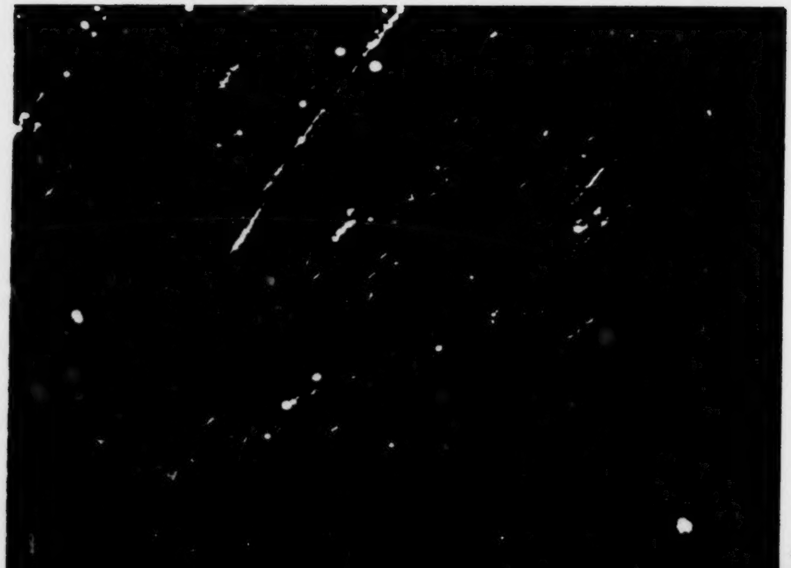
Photo No.	Index No.	Description	Spectra No.
1	1126-01	Area View; 50x; BEI	
2	1126-02	Grain #1; 100x; BEI	1,2,3,4,5,6
3	1126-03	Grain #2; 100x; BEI	7,8,9,10
4	1126-05	Grain #3; 100x; BEI	11,12,13



1



2

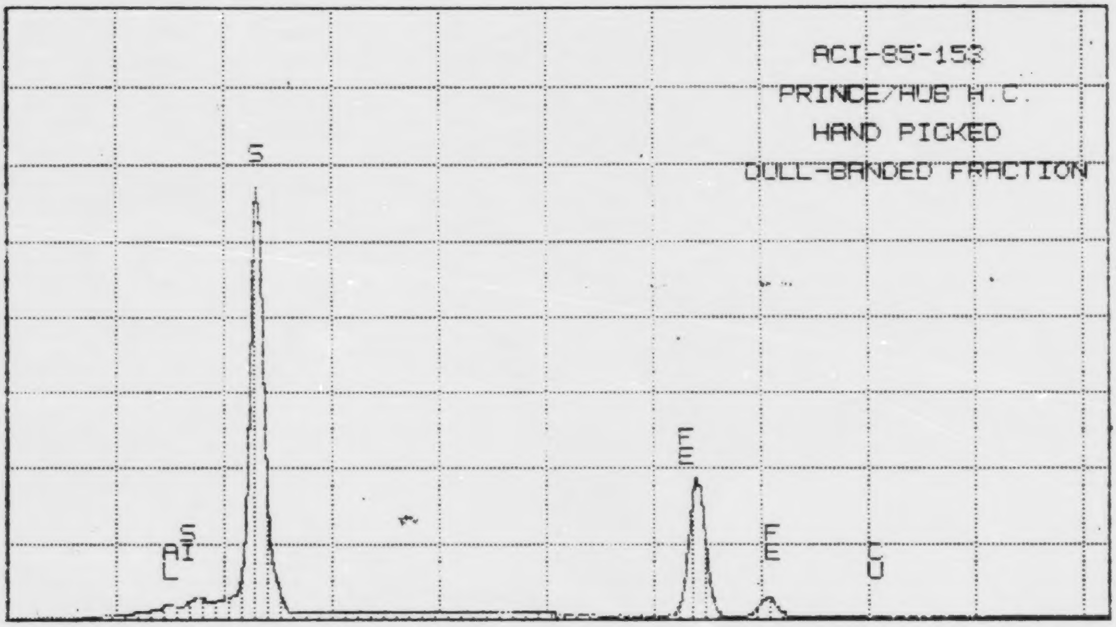


3

4

ATLANTIC COAL INSTITUTE WED 26-NOV-86 11:40

Cursor: 0.000keV = 0



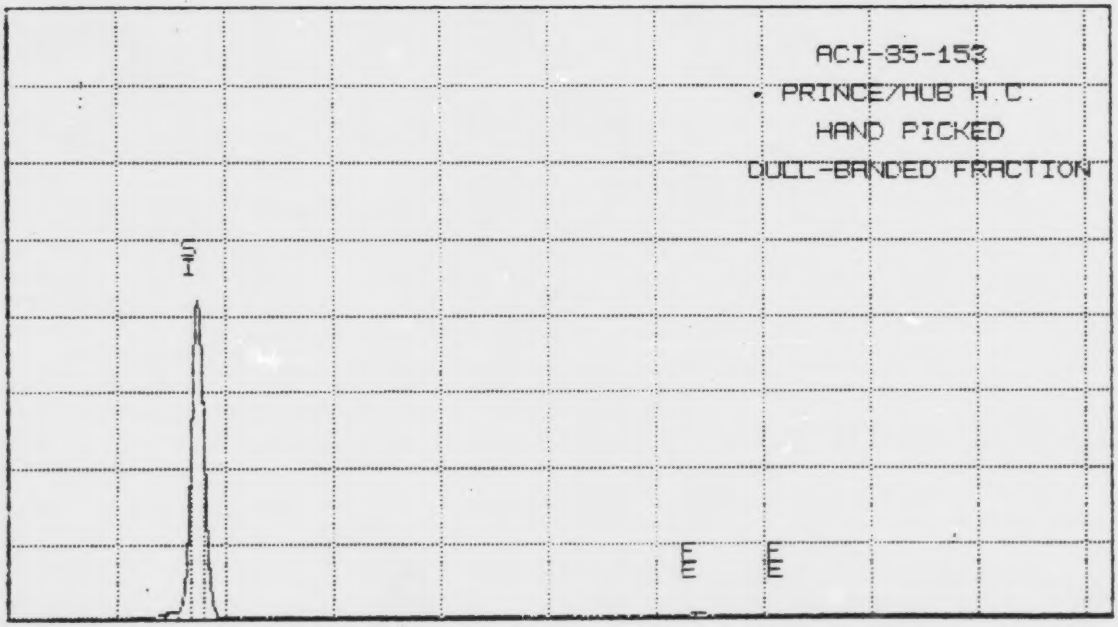
1

0.000 VFS = 16384 10.240

50 MINERAL: **P** PHOTO#1126-02.EDX1

ATLANTIC COAL INSTITUTE WED 26-NOV-86 11:42

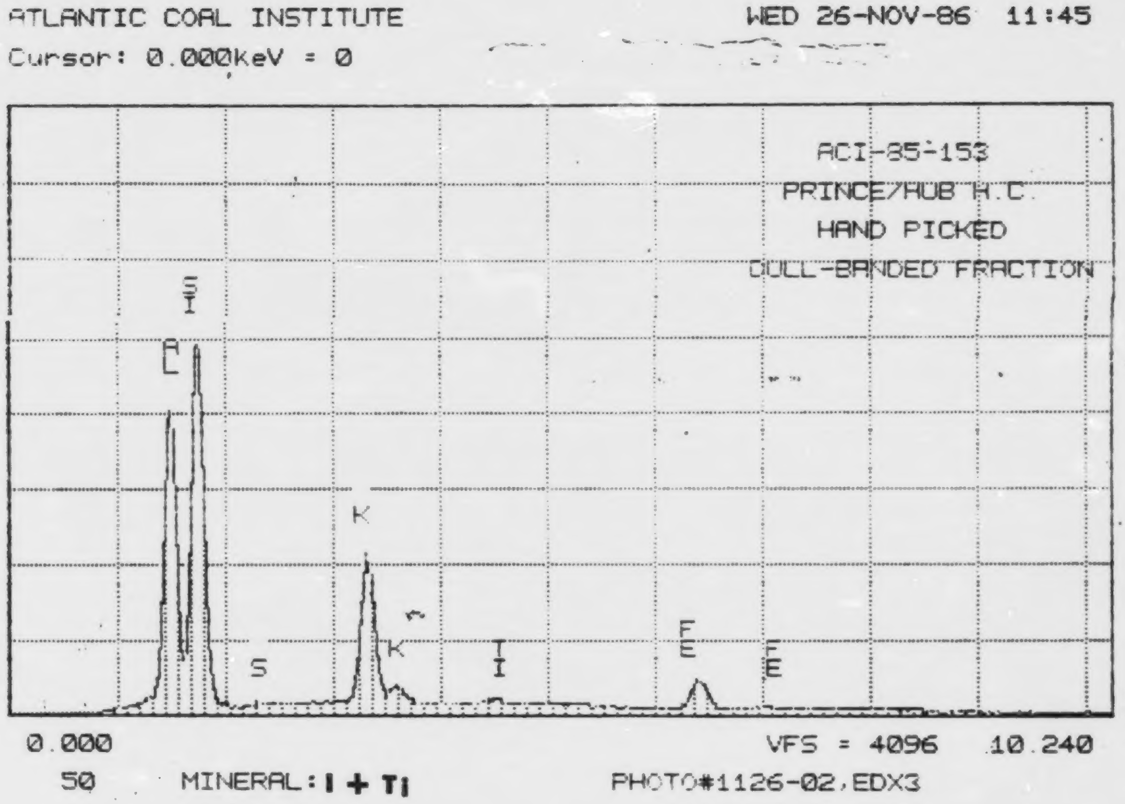
Cursor: 0.000keV = 0



2

0.000 VFS = 16384 10.240

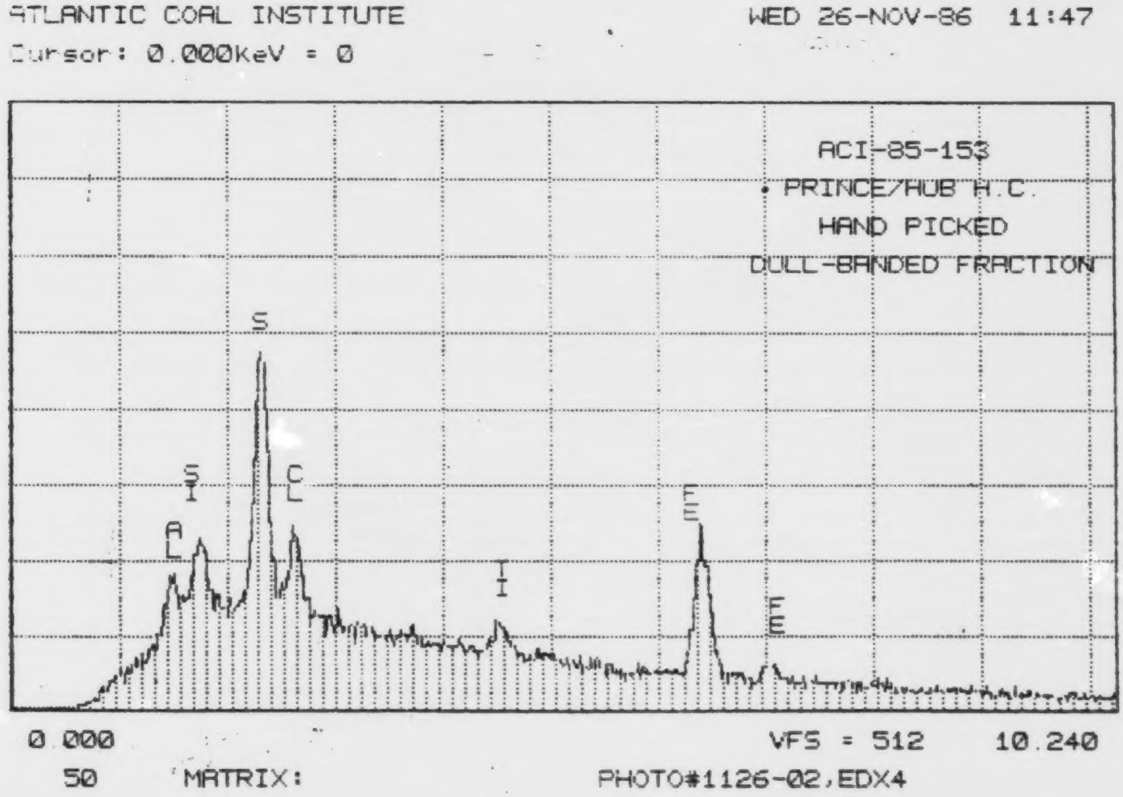
50 MINERAL: **Q** PHOTO#1126-02.EDX2



ATLANTIC COAL INSTITUTE WED 26-NOV-86 11:45
Cursor: 0.000keV = 0

0.000 VFS = 4096 10.240
50 MINERAL: I + Ti PHOTO#1126-02,EDX3

3



ATLANTIC COAL INSTITUTE WED 26-NOV-86 11:47
Cursor: 0.000keV = 0

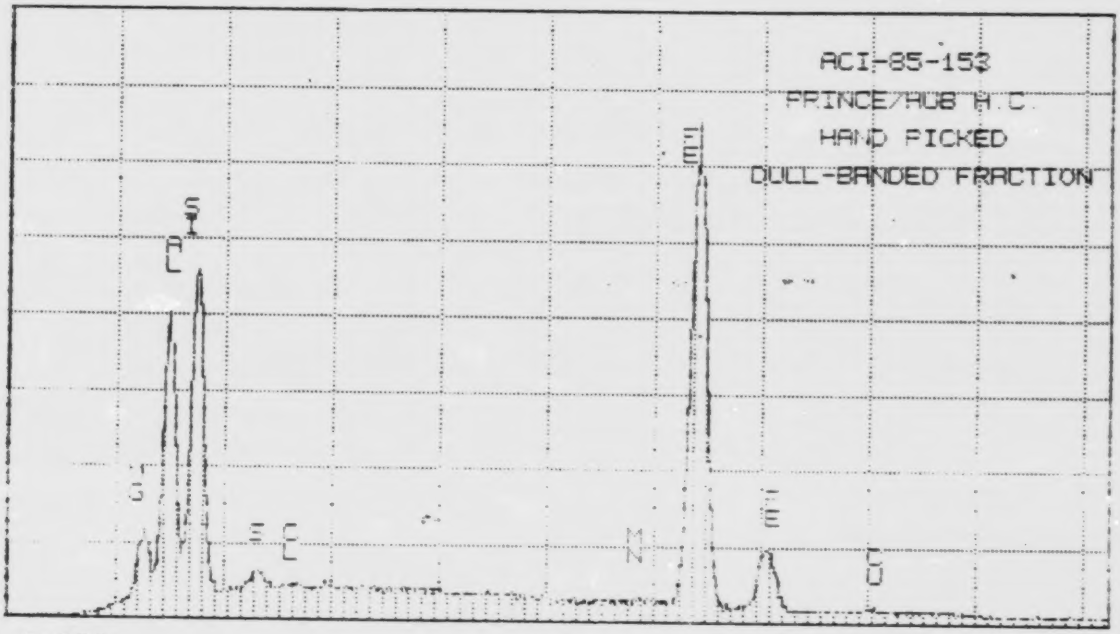
0.000 VFS = 512 10.240
50 MATRIX: PHOTO#1126-02,EDX4

4

ATLANTIC COAL INSTITUTE

WED 26-NOV-86 11:49

Cursor: 0.000keV = 0



ACI-85-153
PRINCE/HUB H.C.
HAND PICKED
DULL-BANDED FRACTION

5

0.000

50 MINERAL:**Ch?**

VFS = 2048 10.240

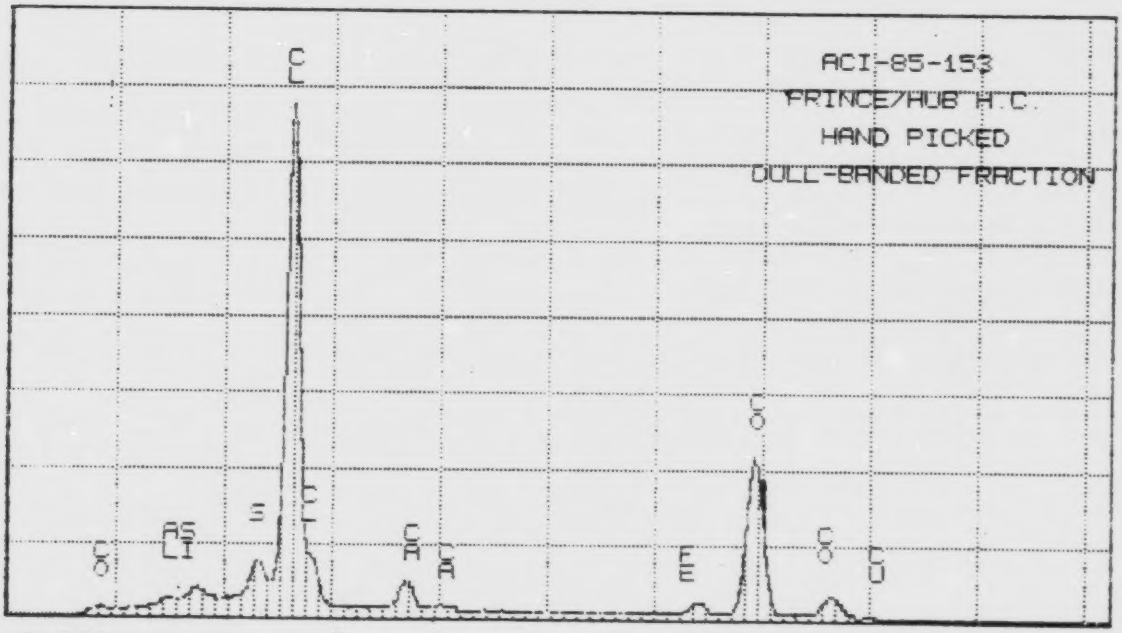
PHOTO#1126-02.EDX5

ATLANTIC COAL INSTITUTE

WED 26-NOV-86 11:51

Cursor: 0.000keV = 0

0.000



ACI-85-153
PRINCE/HUB H.C.
HAND PICKED
DULL-BANDED FRACTION

6

0.000

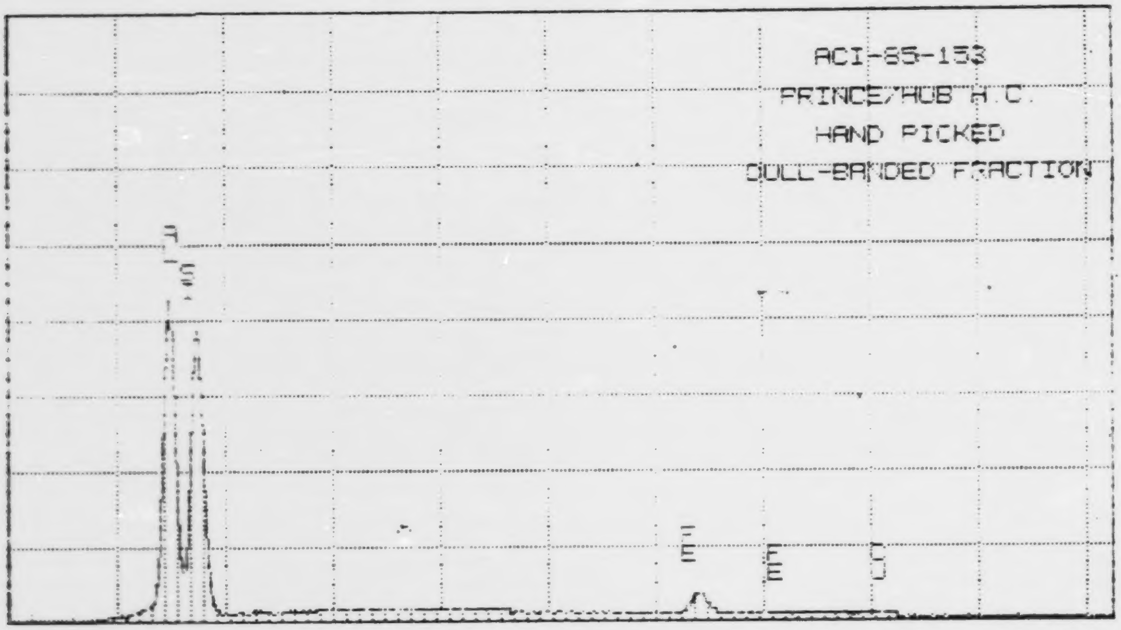
50 CONTAMINANT:

VFS = 8192 10.240

PHOTO#1126-02.EDX6

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:02

Cursor: 0.000keV = 0



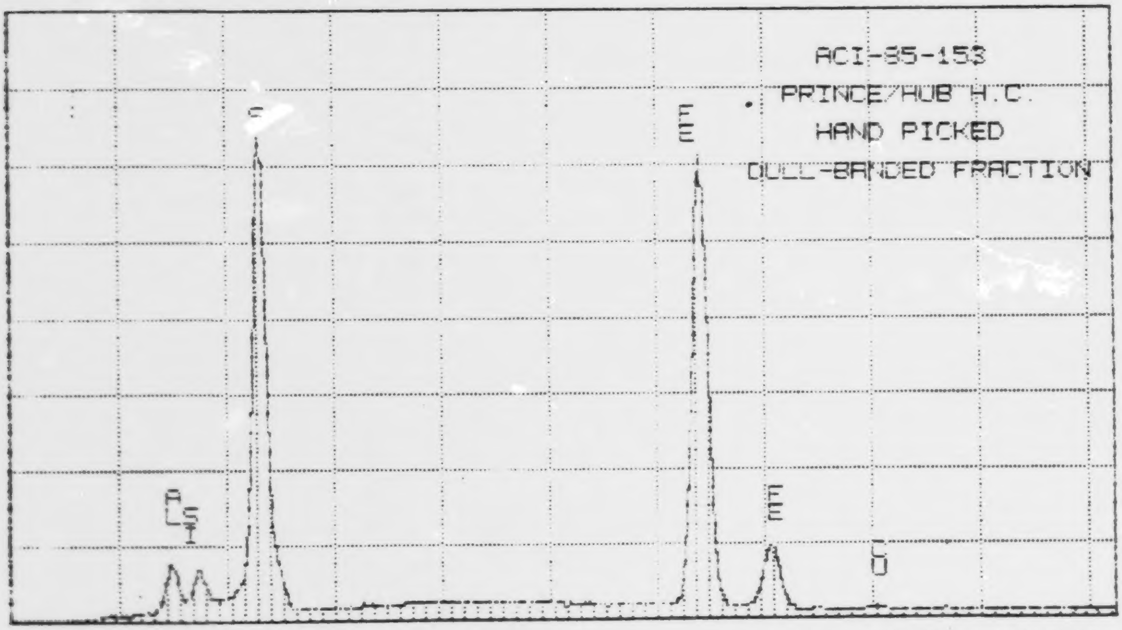
7

0.000 VFS = 4096 10.240

50 MINERAL: **K** PHOTO#1126-03,EDX1

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:04

Cursor: 0.000KeV = 0

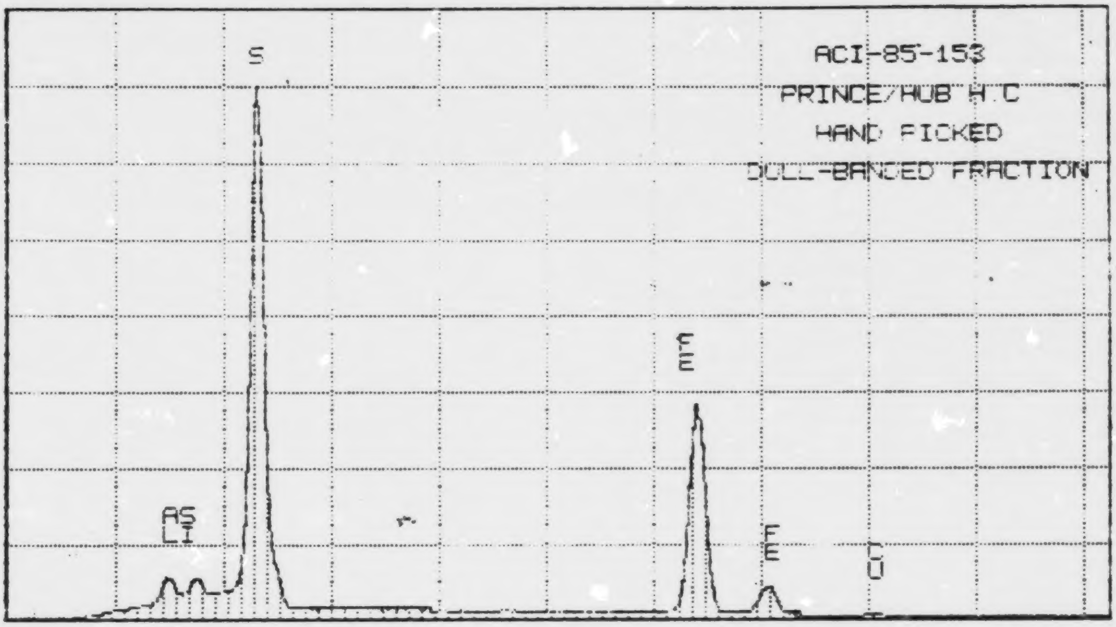


8

0.000 VFS = 4096 10.240

50 MINERAL: **FeS?** PHOTO#1126-03,EDX2

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:06
Cursor: 0.000keV = 0

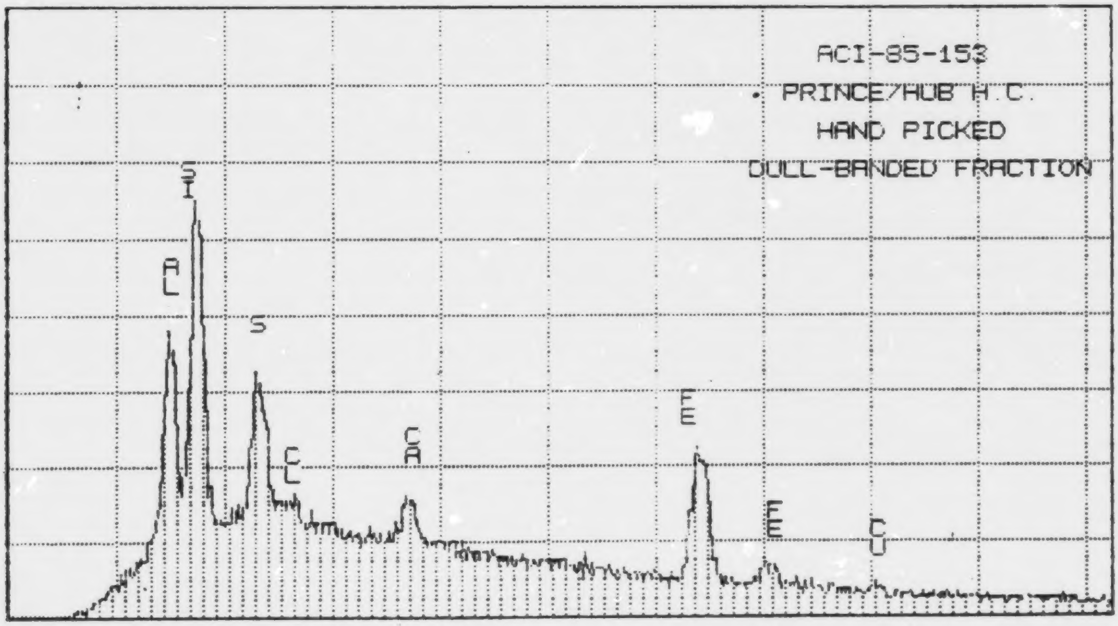


ACI-85-153
PRINCE/HUB H.C
HAND PICKED
DULL-BANDED FRACTION

9

0.000 VFS = 8192 10.240
50 MINERAL:**P** PHOTO#1126-03,EDX3

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:08
Cursor: 0.000keV = 0

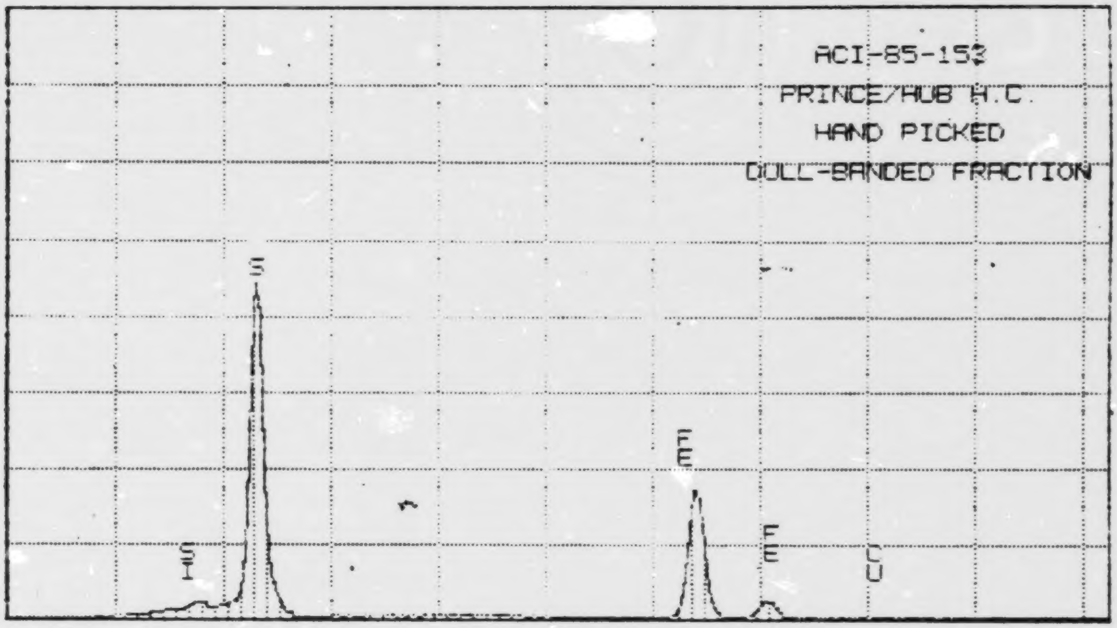


ACI-85-153
PRINCE/HUB H.C.
HAND PICKED
DULL-BANDED FRACTION

10

0.000 VFS = 512 10.240
50 MATRIX: PHOTO#1126-03,EDX4

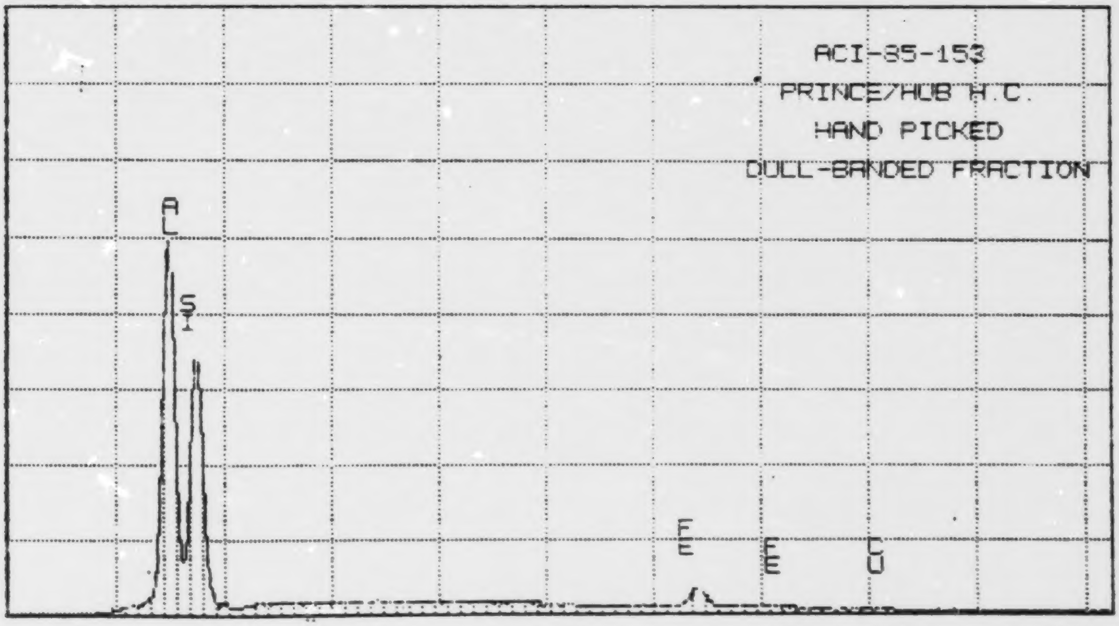
ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:23
Cursor: 0.000keV = 0



11

0.000 VFS = 16384 10.240
50 MINERAL: **P** PHOTO#1126-05.EDX1

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:25
Cursor: 0.000keV = 0

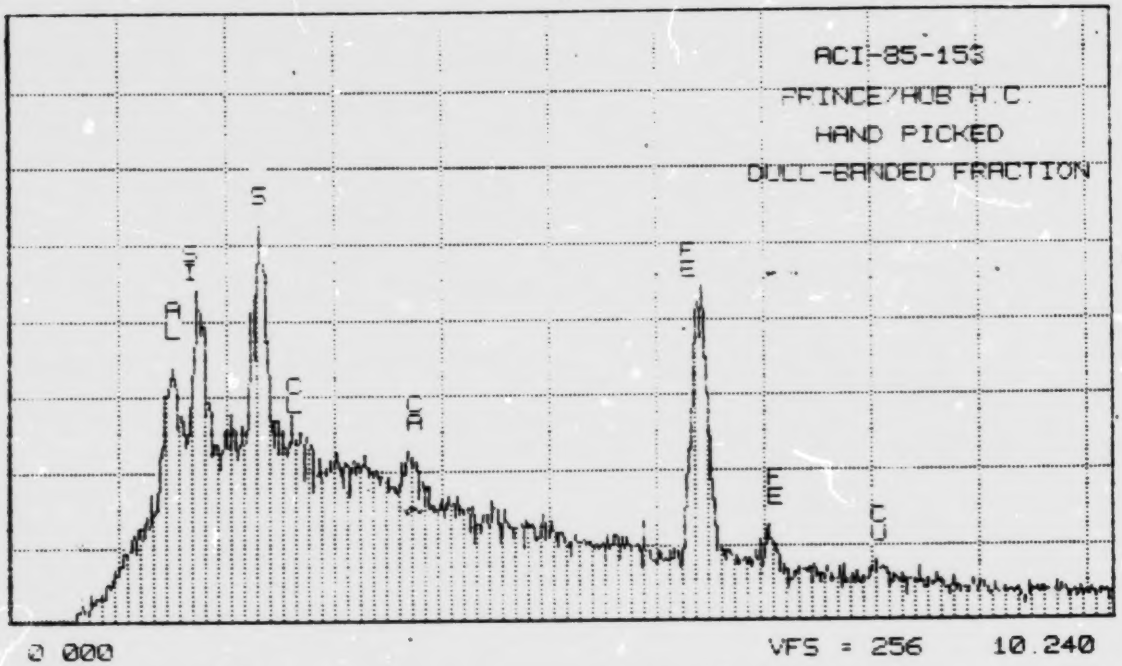


12

0.000 VFS = 4096 10.240
50 MINERAL: **K** PHOTO#1126-05.EDX2

ATLANTIC COAL INSTITUTE WED 26-NOV-86 12:27

Cursor: 0.000keV = 0



13

50 MATRIX: PHOTO#1126-05,EDX3

PLATE 6

MINERAL ANALYSIS
Minto/Chipman #2 -1/2" subsample, hand-picked, bright fraction

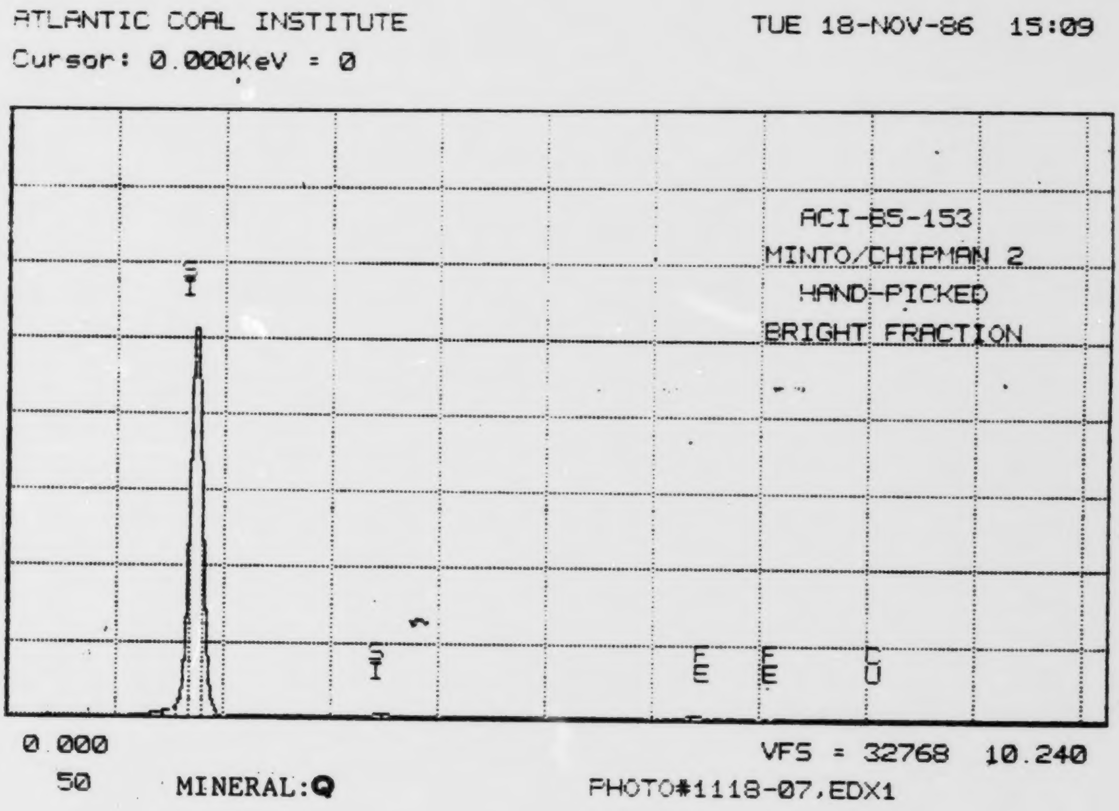
Photo No.	Index No.	Description	Spectra No.
1	1118-01	Area View; 50x; BEI	
2	1118-07	Grain #1; 150x; BEI	1,2,3,4,5,6,7,8,9
3	1118-08	Grain #2; 100x; BEI	10,11
4	1118-09	Grain #3; 200x; BEI	12,13,14,15

1

2

3

4

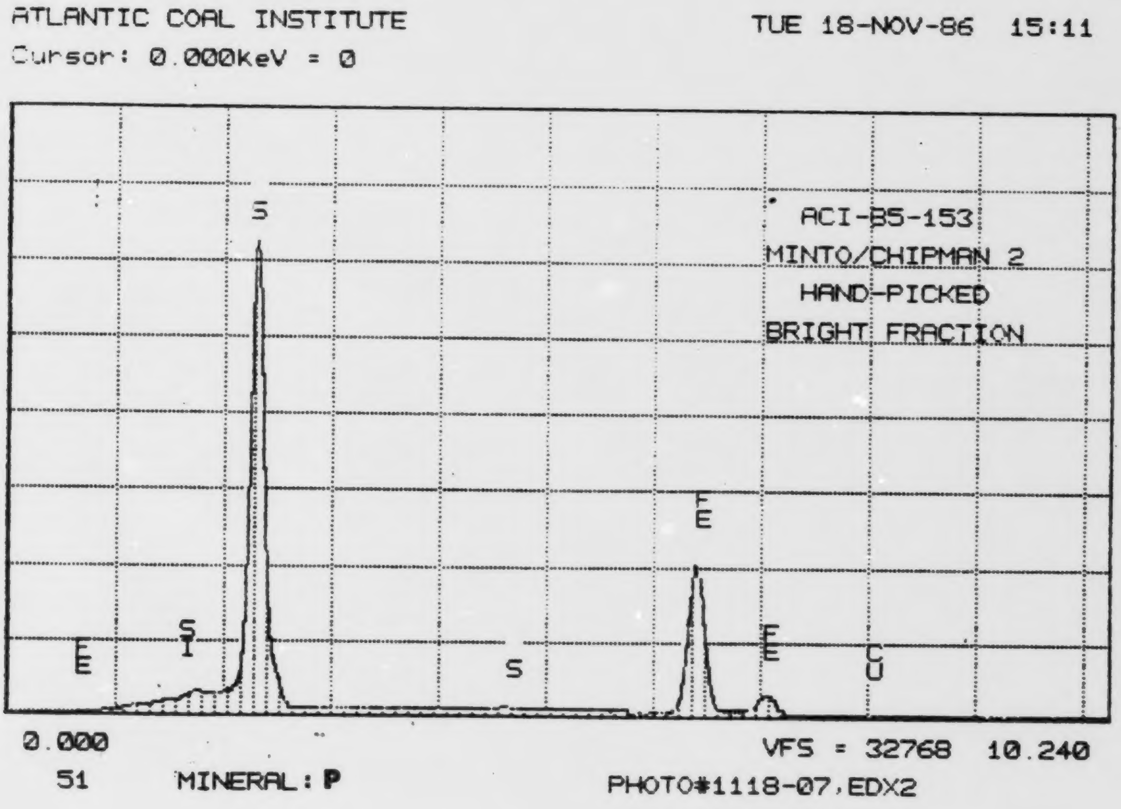


ATLANTIC COAL INSTITUTE
TUE 18-NOV-86 15:09
Cursor: 0.000keV = 0

ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT FRACTION

0.000
50
MINERAL:**Q**
VFS = 32768 10.240
PHOTO#1118-07.EDX1

1



ATLANTIC COAL INSTITUTE
TUE 18-NOV-86 15:11
Cursor: 0.000keV = 0

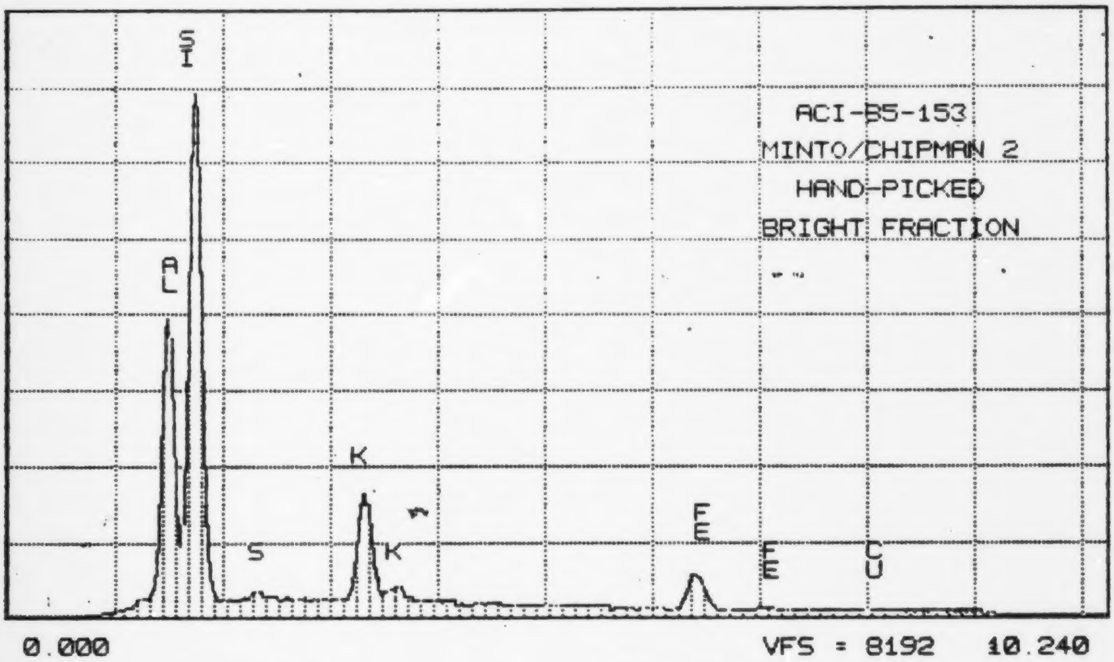
ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT FRACTION

0.000
51
MINERAL: **P**
VFS = 32768 10.240
PHOTO#1118-07.EDX2

2

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:13

Cursor: 0.000keV = 0

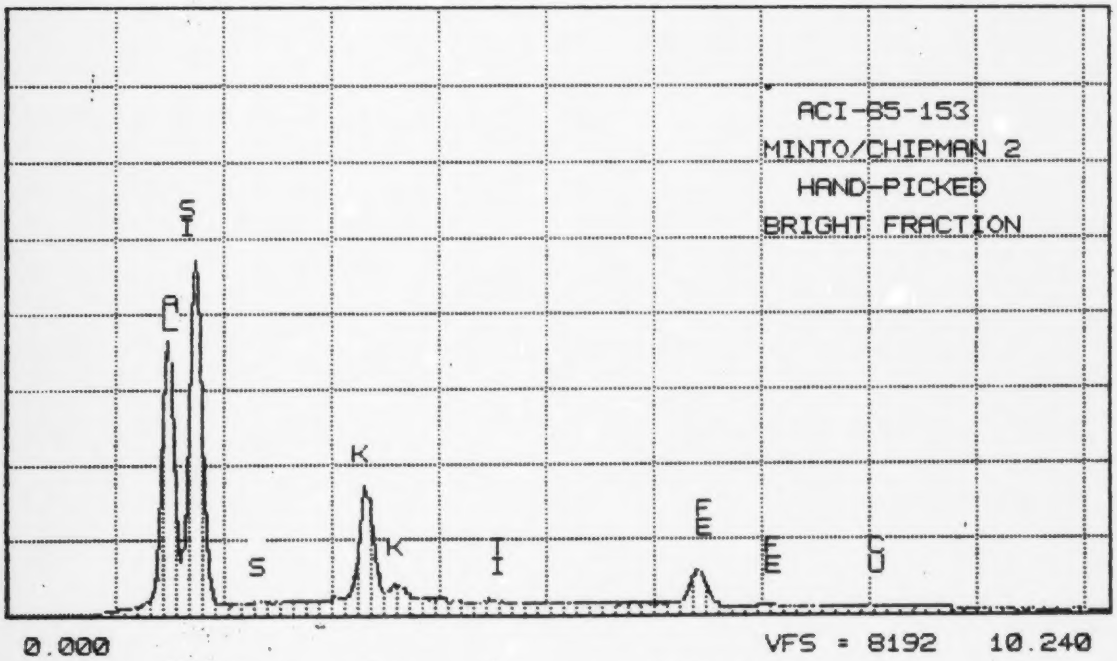


3

50 MINERAL: I PHOTO#1118-07, EDX3

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:15

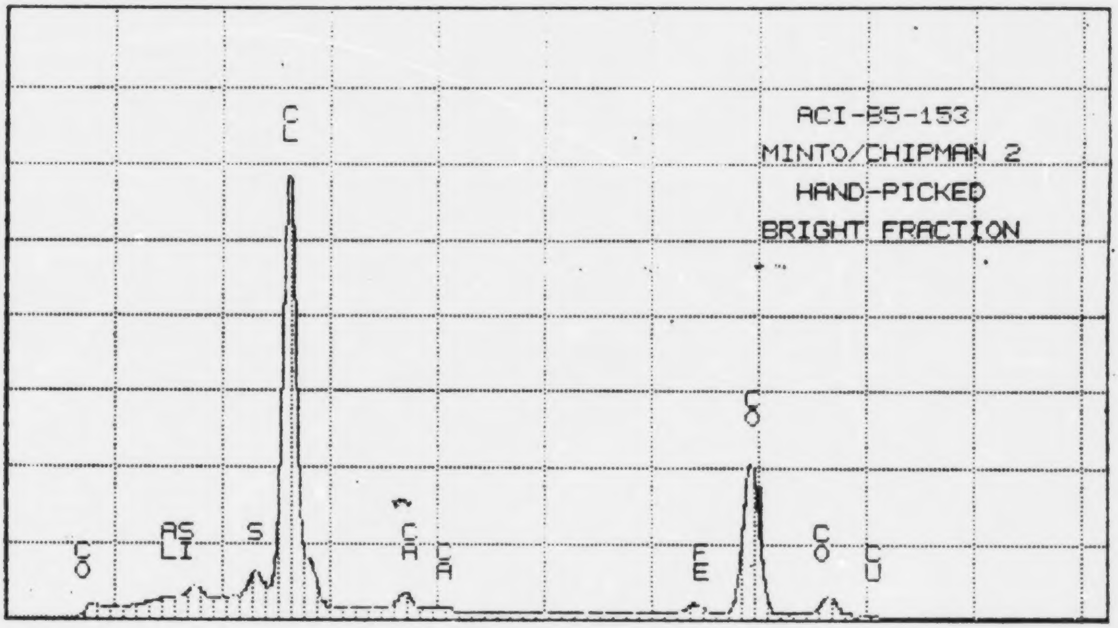
Cursor: 0.000keV = 0



4

50 MINERAL: I + TI PHOTO#1118-07, EDX4

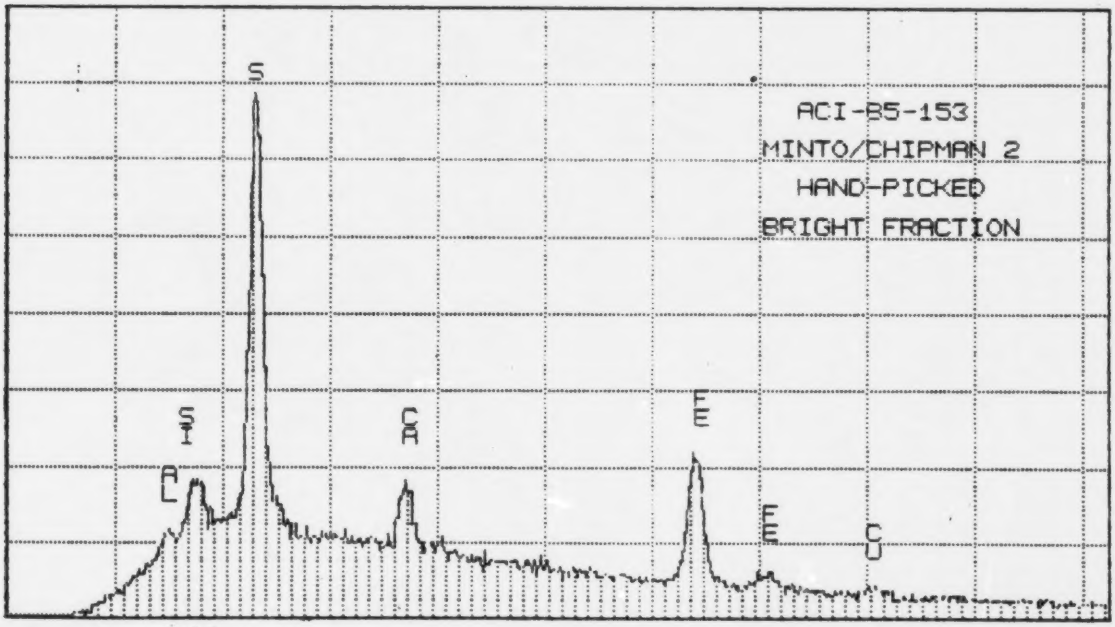
ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:17
Cursor: 0.000keV = 0



5

0.000 VFS = 16384 10.240
50 CONTAMINANT: PHOTO#1118-07,EDX5

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:20
Cursor: 0.000keV = 0

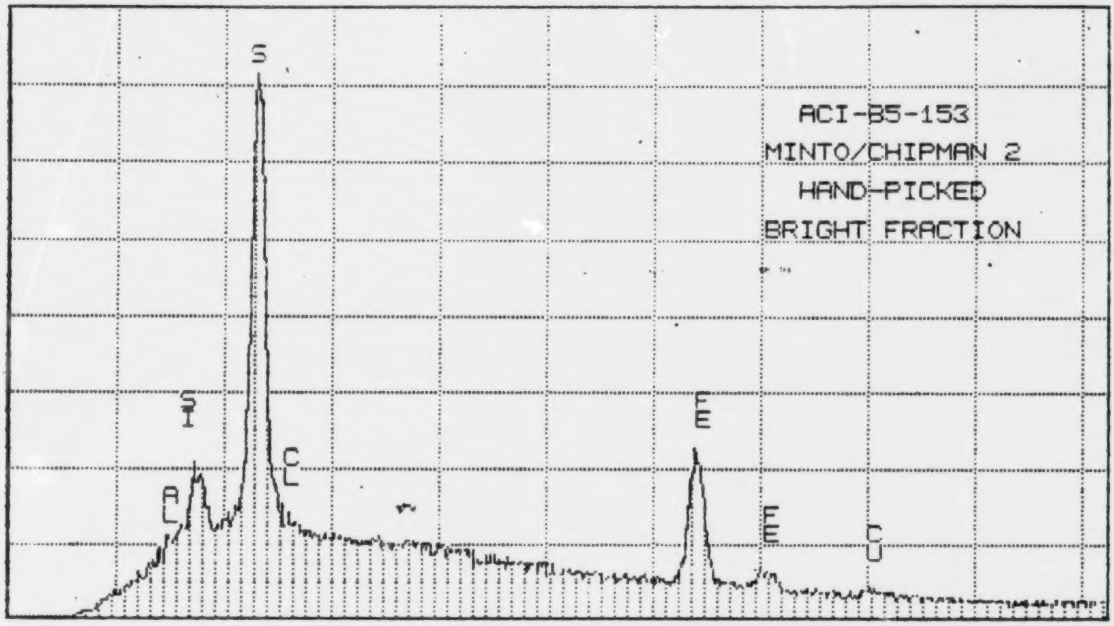


6

0.000 VFS = 1024 10.240
50 MATRIX DK: PHOTO#1118-07,EDX6

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:22

Cursor: 0.000keV = 0



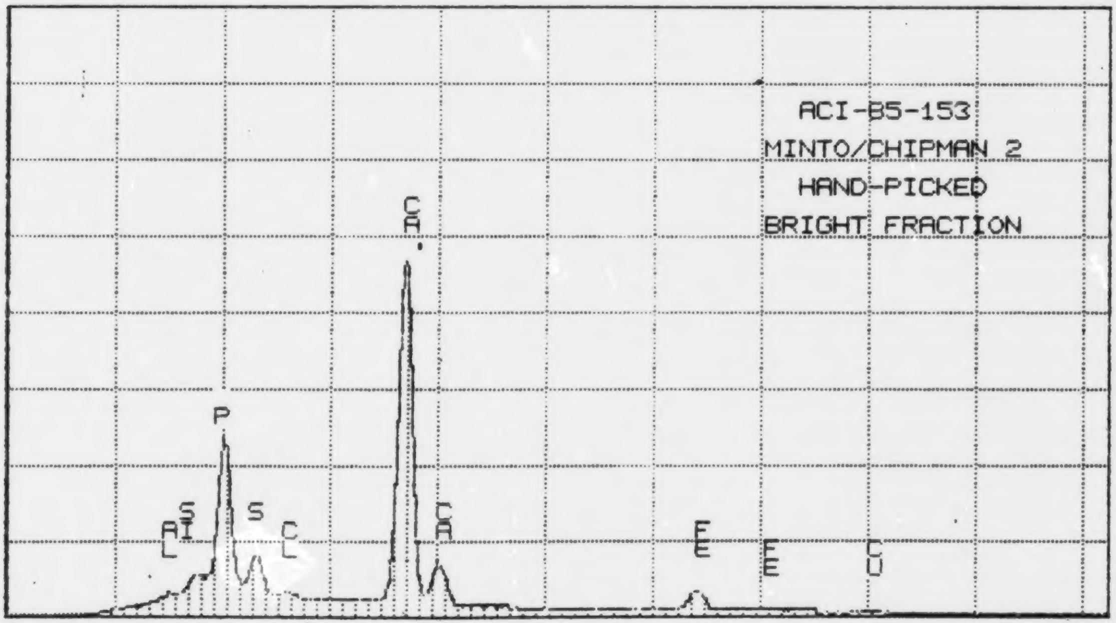
7

0.000 VFS = 1024 10.240

50 MATRIX LT: PHOTO#1118-07.EDX7

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:24

Cursor: 0.000keV = 0



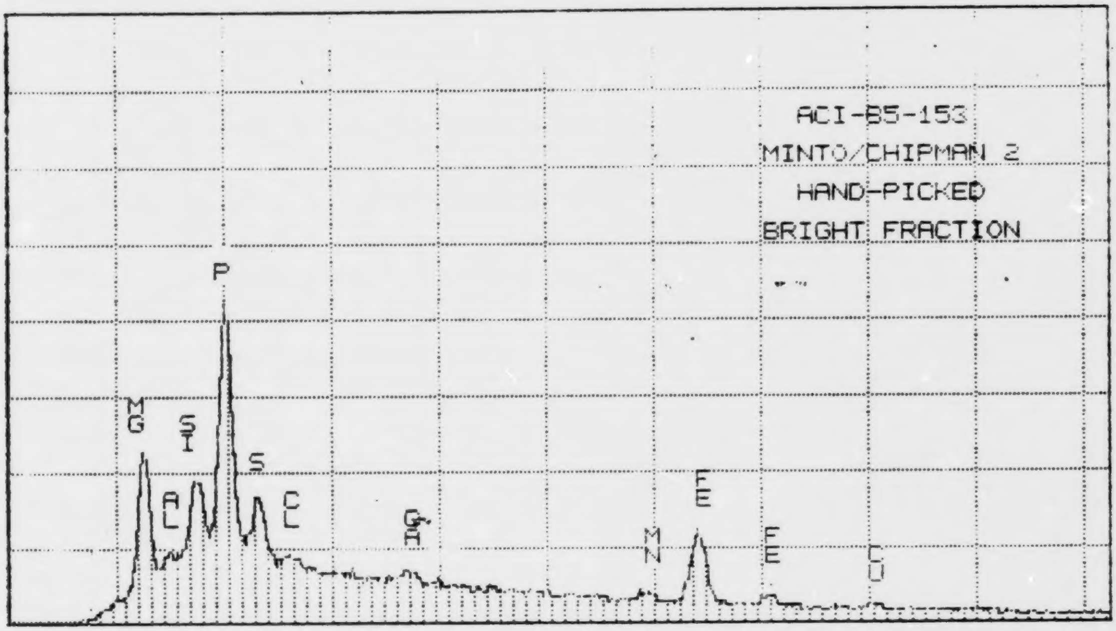
8

0.000 VFS = 8192 10.240

50 MINERAL: **Ap** PHOTO#1118-07.EDX8

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:26

Cursor: 0.000keV = 0


ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT FRACTION

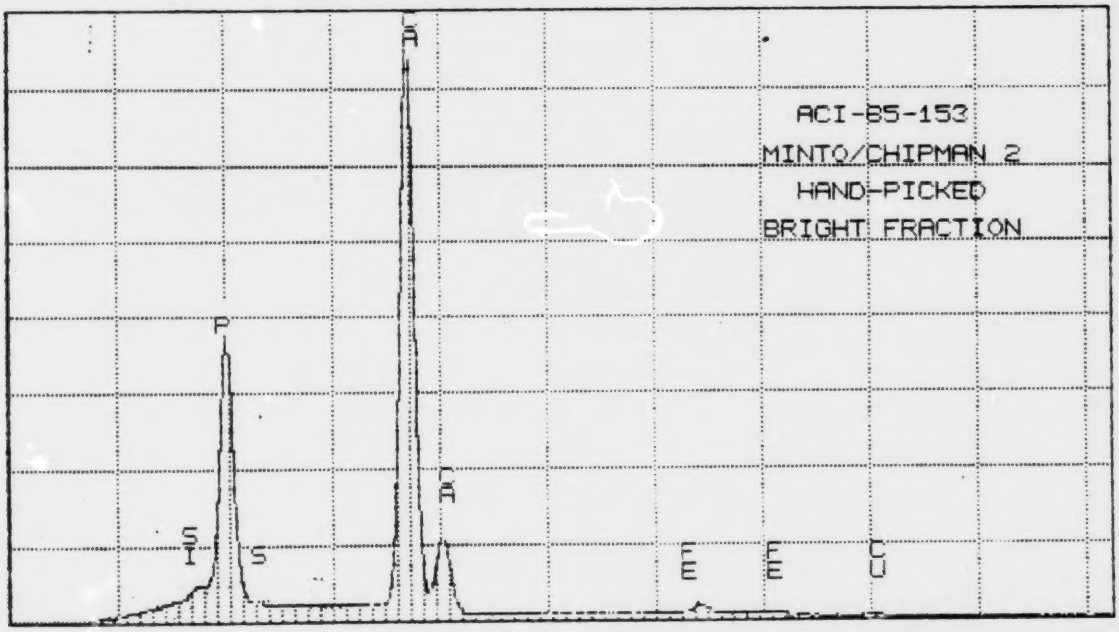
9

0.000 VFS = 2048 10.240

50 MATRIX: PHOTO#1118-07,EDX9

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:37

Cursor: 0.000keV = 0


ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT FRACTION

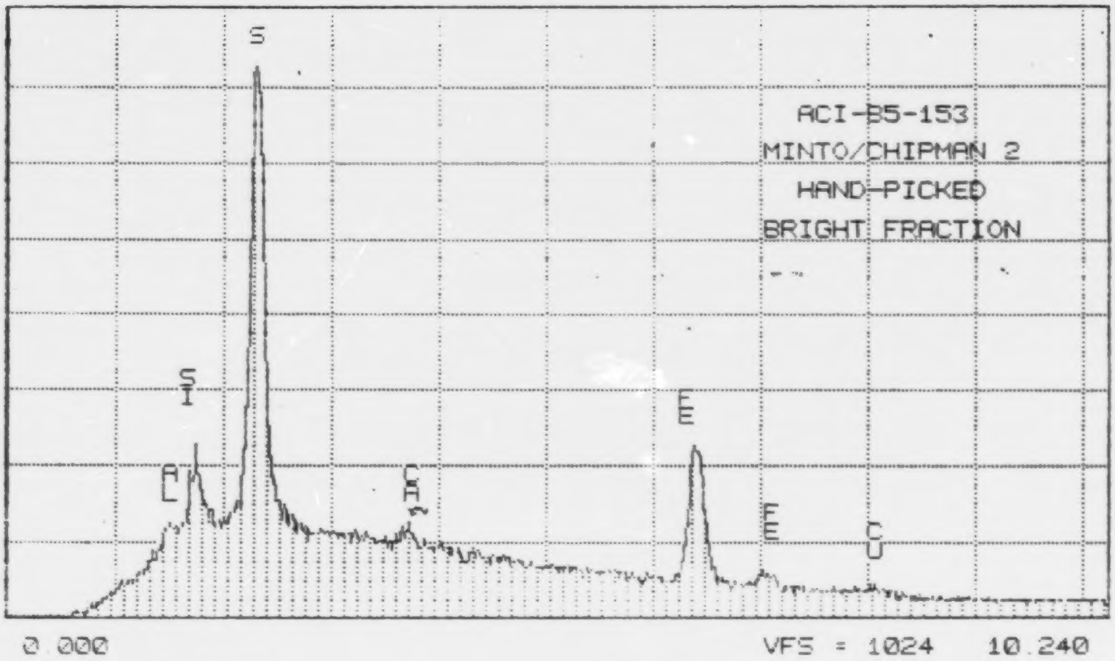
10

0.000 VFS = 16384 10.240

50 MINERAL:**Ap** PHOTO#1118-08,EDX1

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:42

Cursor: 0.000keV = 0

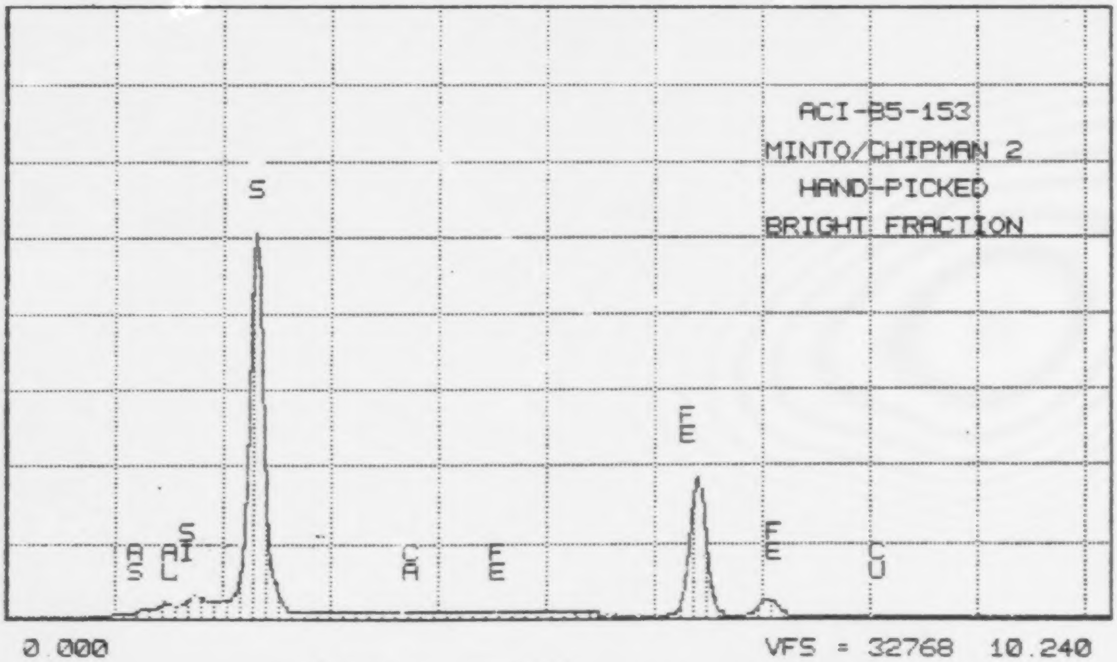


11

50 MATRIX: PHOTO#1118-08,EDX2

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:46

Cursor: 0.000keV = 0

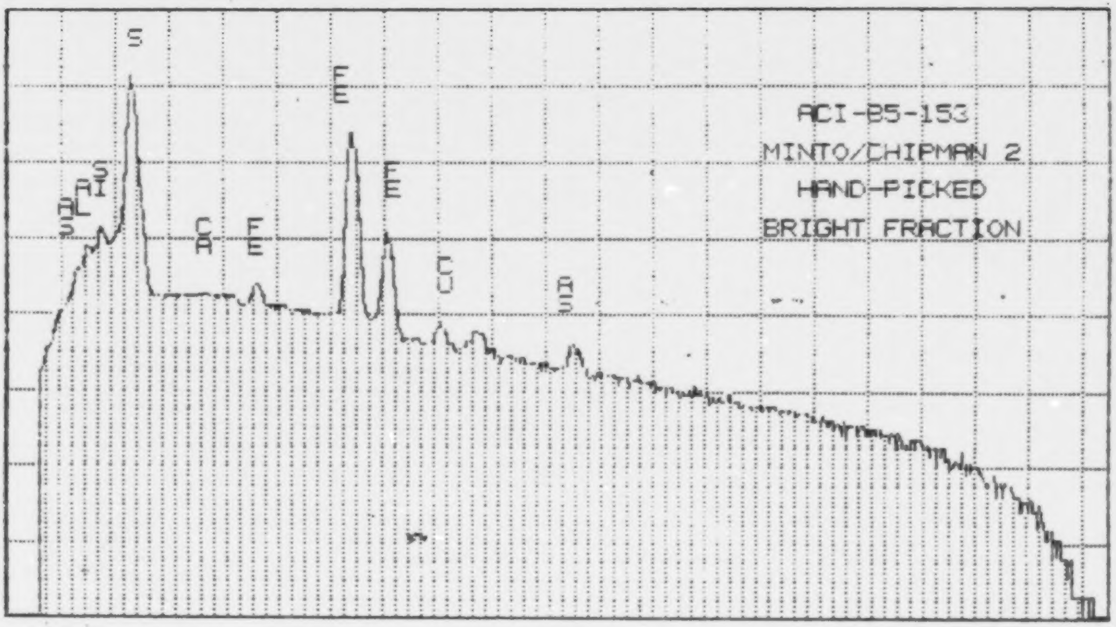


12

50 MINERAL :**P + As** (see EDX 13) PHOTO#1118-09,EDX1

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:49

Cursor: 0.000keV = 0



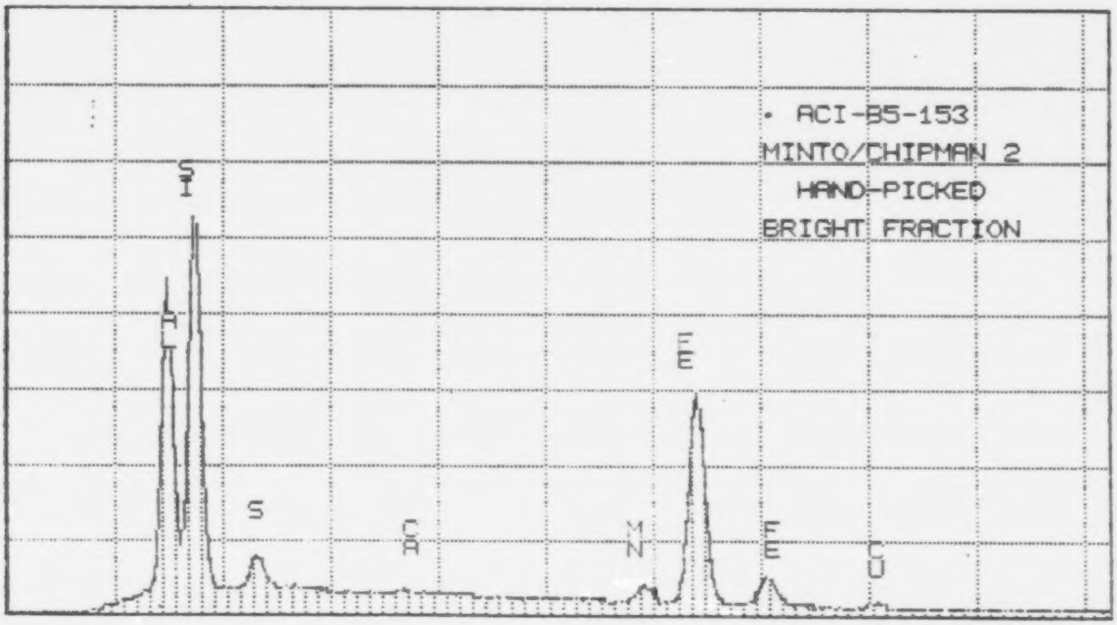
13

0.000 VFS = LOG 1 20.480

50 MINERAL: **P + As** PHOTO#1118-09,EDX1

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:52

Cursor: 0.000keV = 0



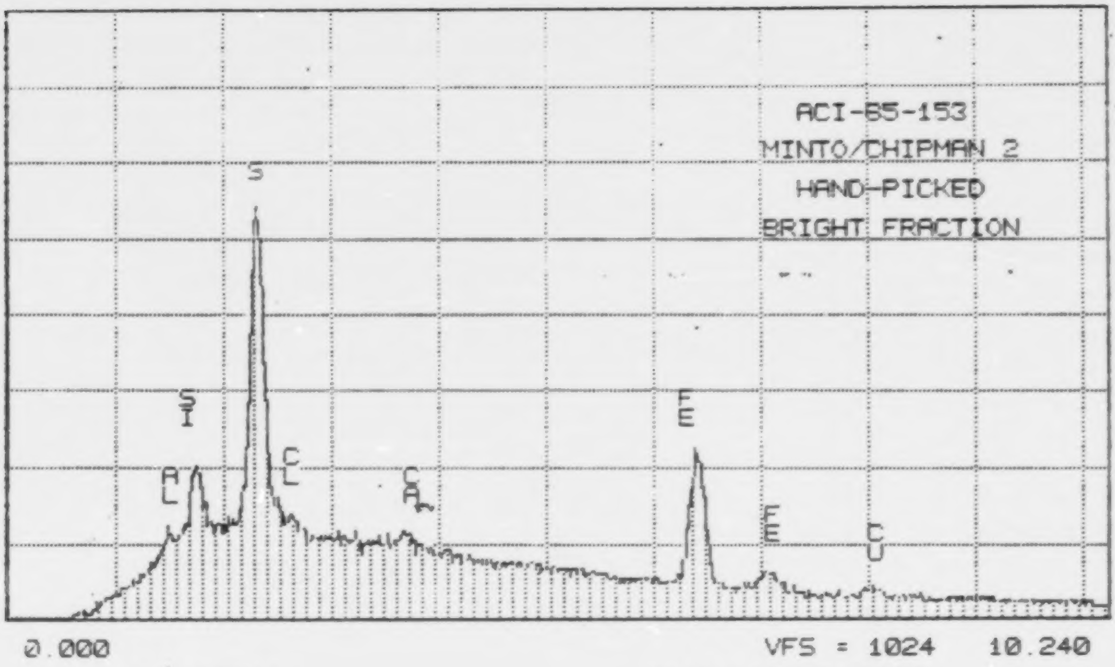
14

0.000 VFS = 4096 10.240

50 MINERAL: **Ch** PHOTO#1118-09,EDX2

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 15:58

Cursor: 0.000keV = 0



15

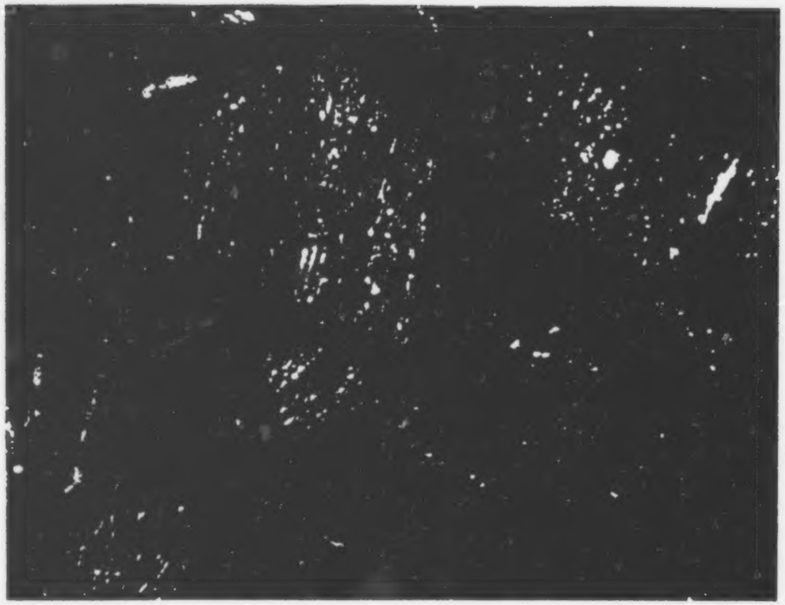
50 MATRIX: PHOTO#1118-09,EDX3

PLATE 7

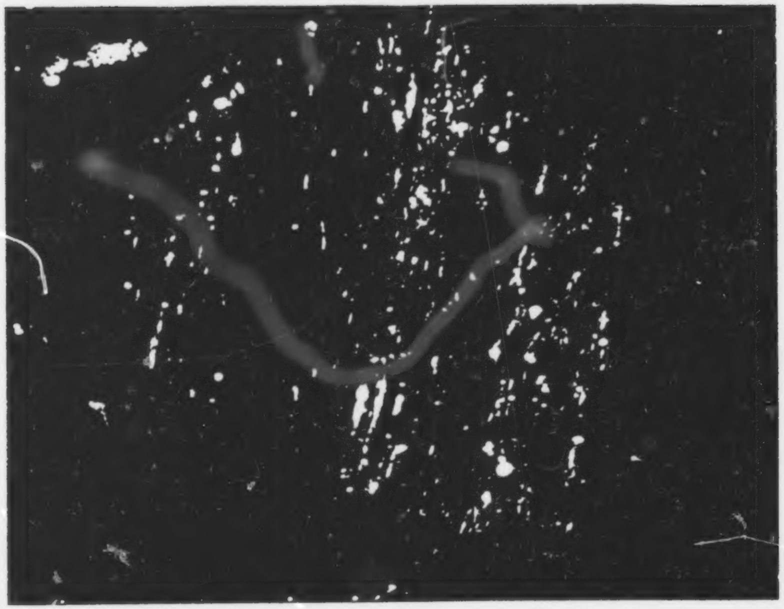
MINERAL ANALYSIS

Minto/Chipman #2 -1/2" subsample, hand-picked, bright banded fraction

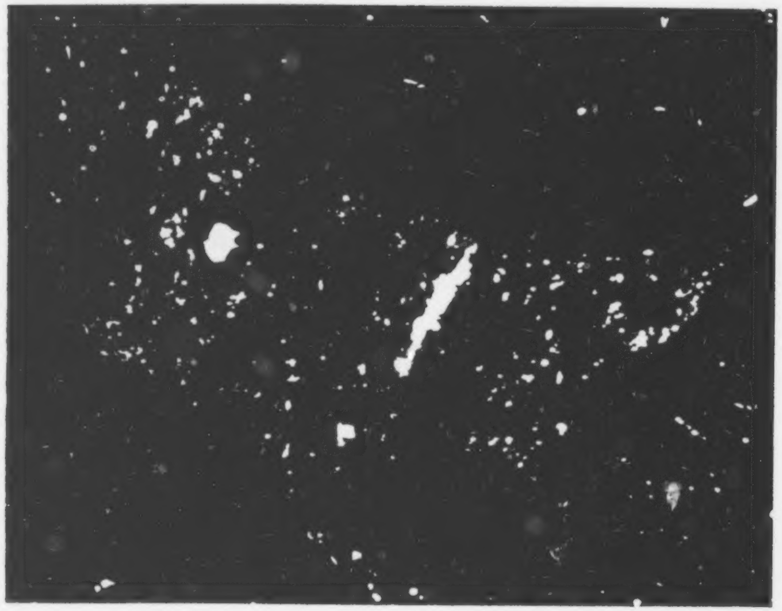
Photo No.	Index No.	Description	Spectra No.
1	1118-01	Area View; 50x; BEI	
2	1118-02	Grain #1; 100x; BEI	1,2,3,4,5,6
3	1118-03	Grain #2; 100x; BEI	7
4	1118-04	Grain #3; 200x; BEI	8,9,10



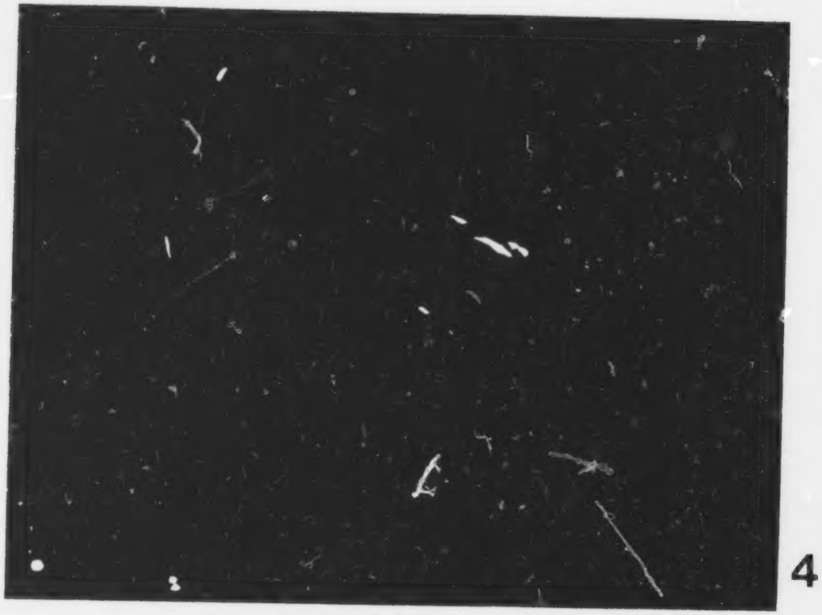
1



2



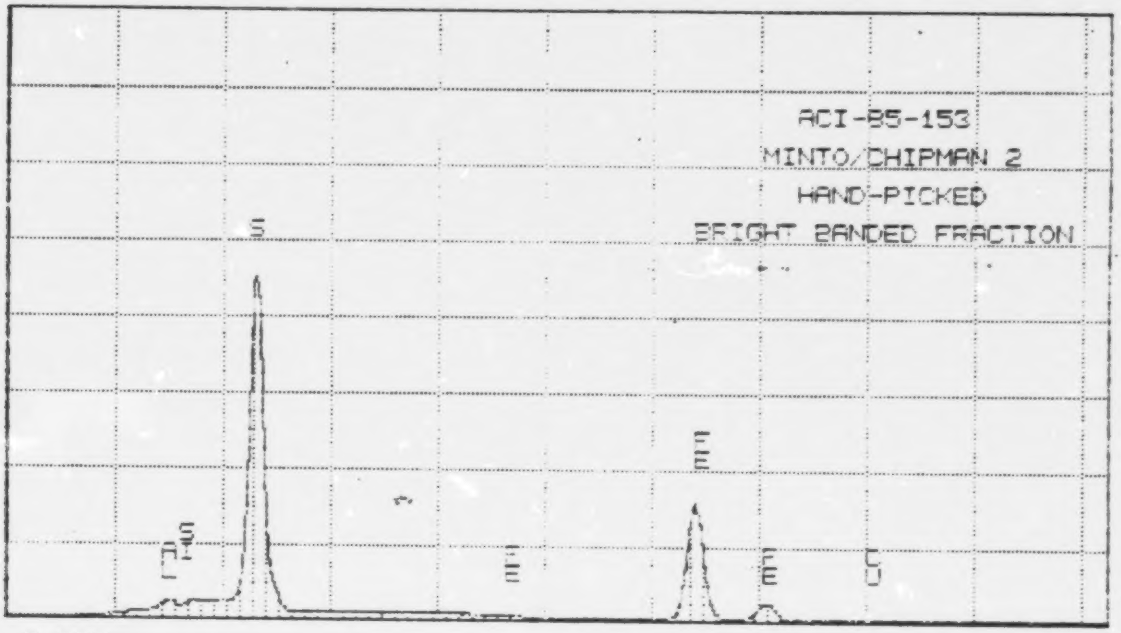
3



4

ATLANTIC COAL INSTITUTE　　　　　　　　TUE 18-NOV-86　11:07

Cursor: 0.000keV = 0



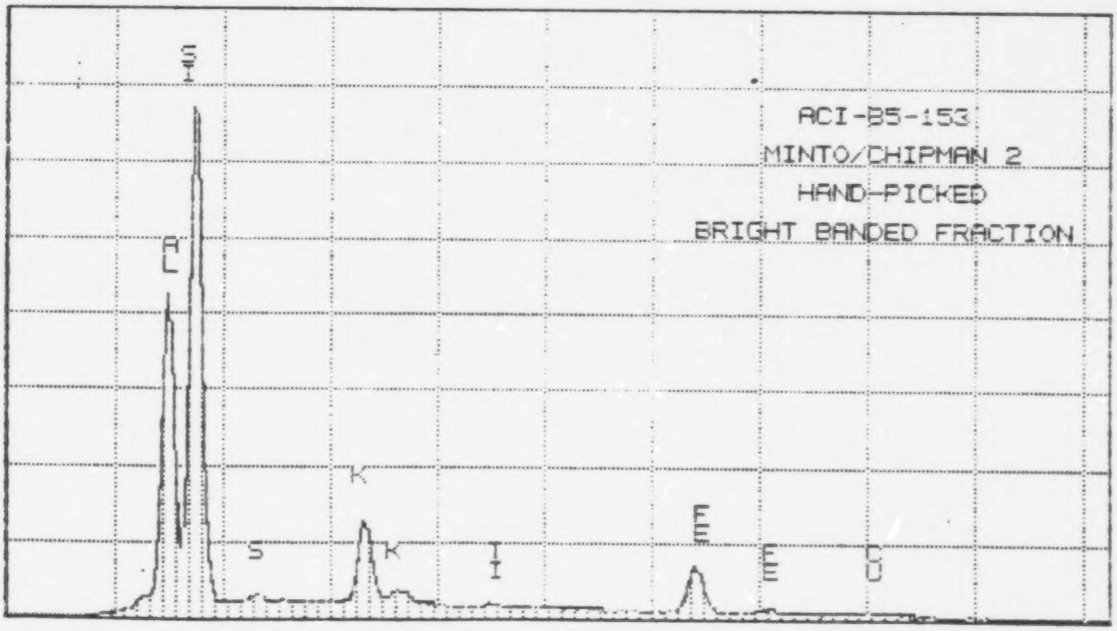
1

0 000　　　　　　　　　　　　　　　　VFS = 32768　10.240

50　　MINERAL: **P**　　　　　　PHOTO#1118-02,EDX1

ATLANTIC COAL INSTITUTE　　　　　　　　TUE 18-NOV-86　11:09

Cursor: 0.000keV = 0



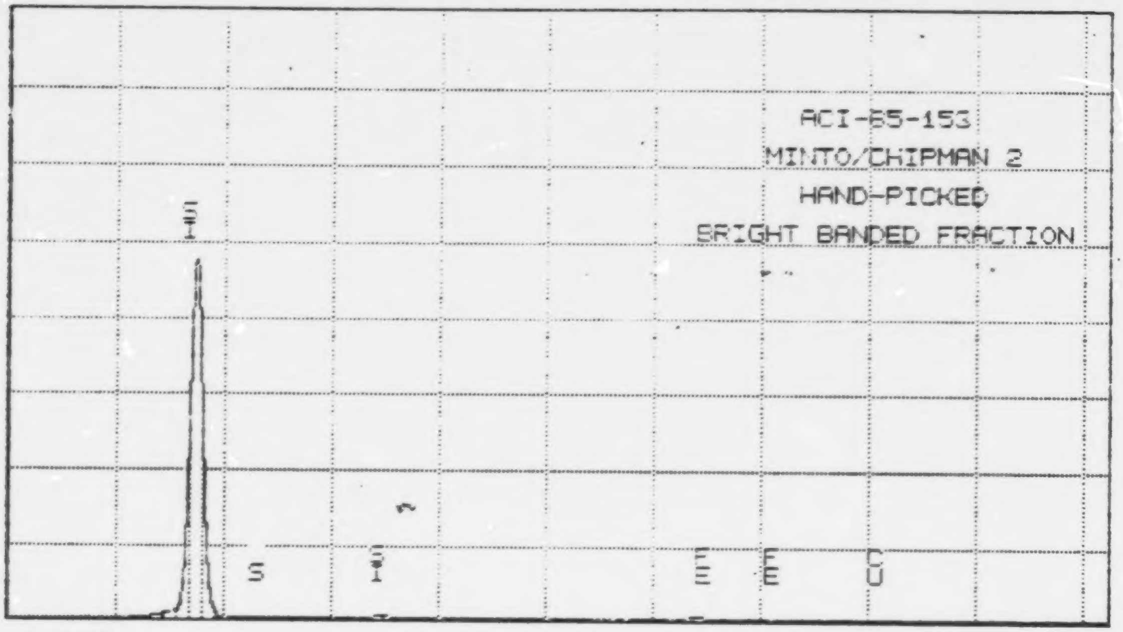
2

0 000　　　　　　　　　　　　　　　　VFS = 8192　10.240

50　　MINERAL: **I+TI**　　　　　　PHOTO#1118-02,EDX2

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:11

Cursor: 0.000keV = 0



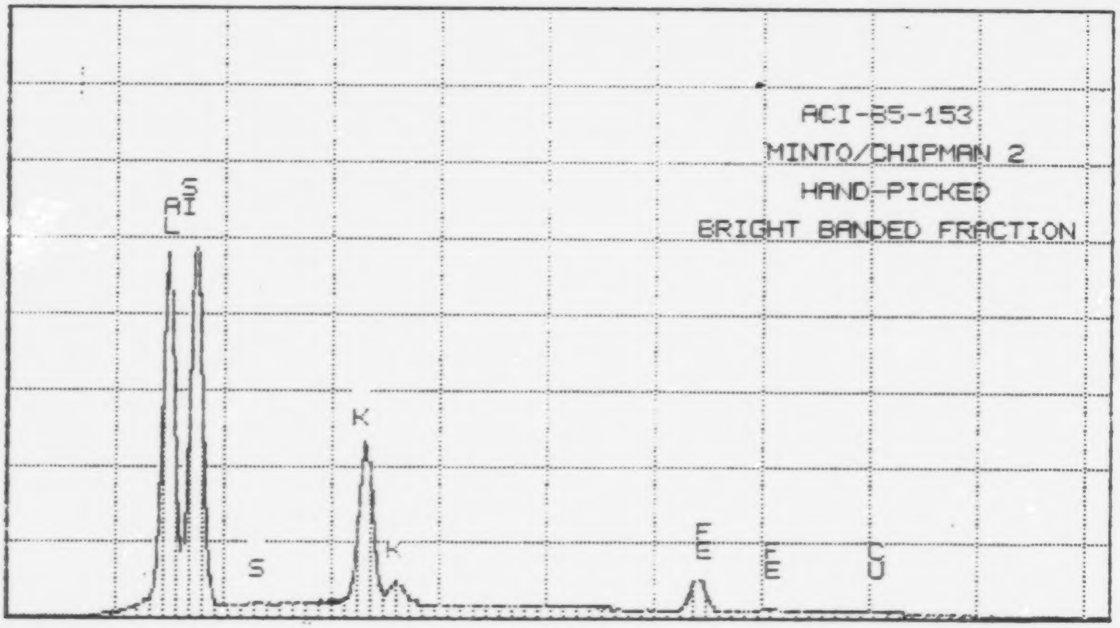
3

0.000 VFS = 32768 10.240

50 MINERAL:Q PHOTO#1118-02,EDX3

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:13

Cursor: 0.000keV = 0



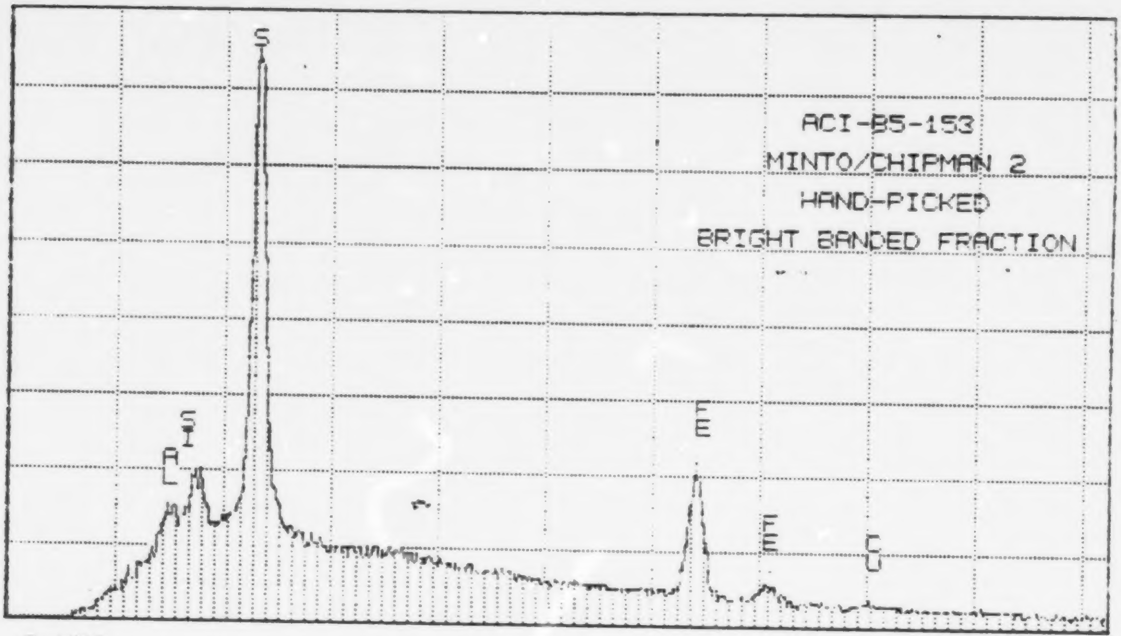
4

0.000 VFS = 8192 10.240

50 MINERAL: I PHOTO#1118-02,EDX4

ATLANTIC COAL INSTITUTE   TUE 18-NOV-86 11:16

Cursor: 0.000keV = 0



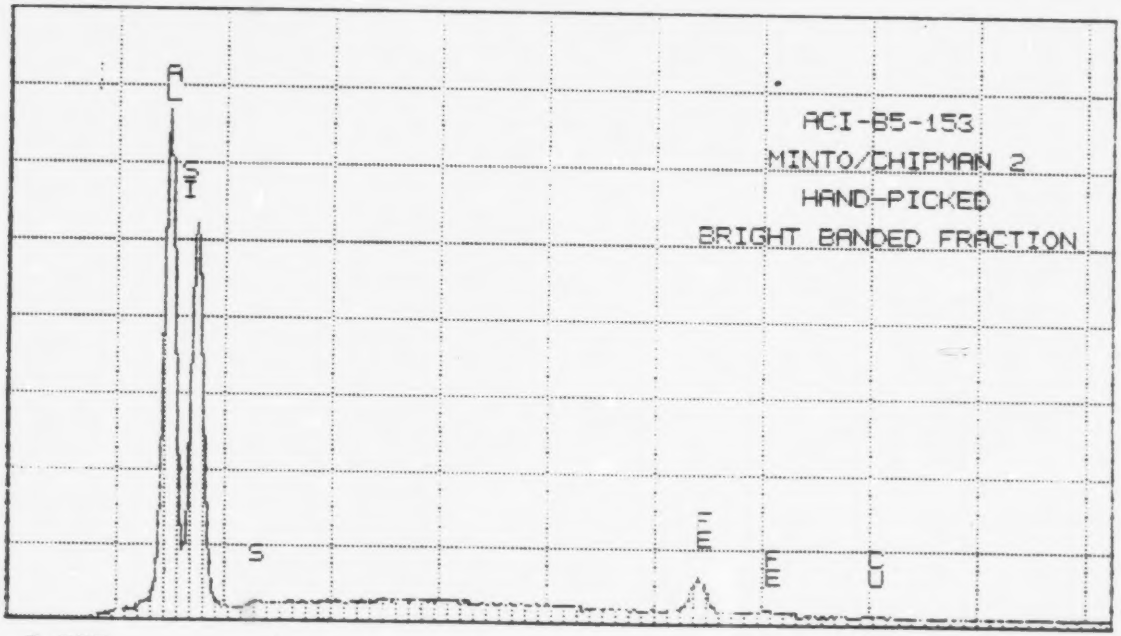
5

0.000   VFS = 1024   10.240

50   MATRIX: PHOTO#1118-02,EDX5

ATLANTIC COAL INSTITUTE   TUE 18-NOV-86 11:18

Cursor: 0.000keV = 0



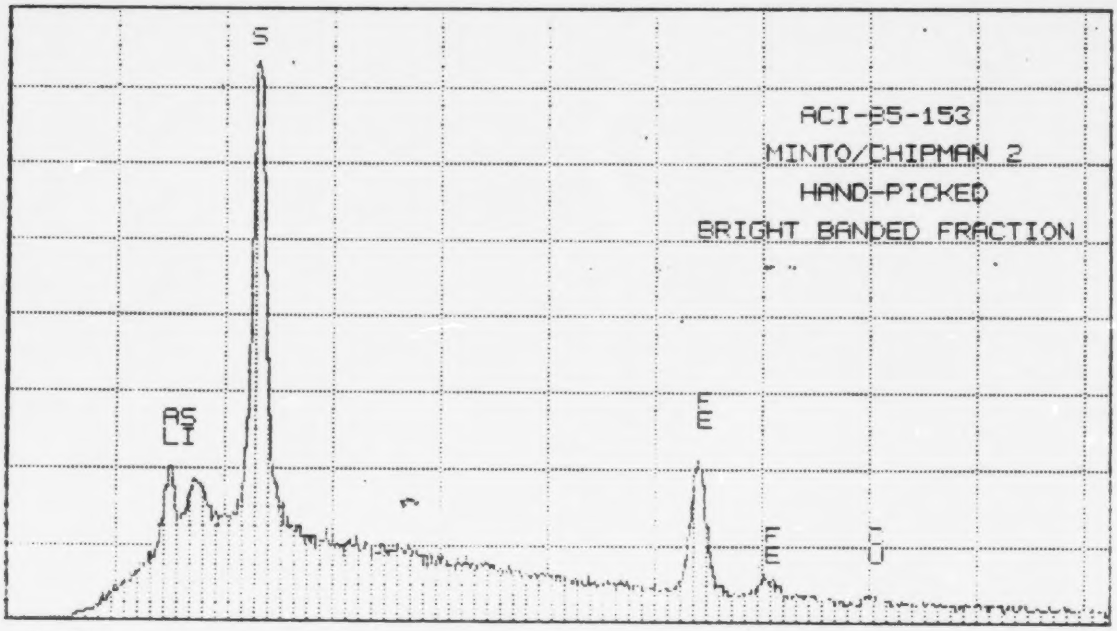
6

0 000   VFS = 4096   10 240

50   MINERAL:**K**   PHOTO#1118-02,EDX6

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:22

Cursor: 0.000keV = 0



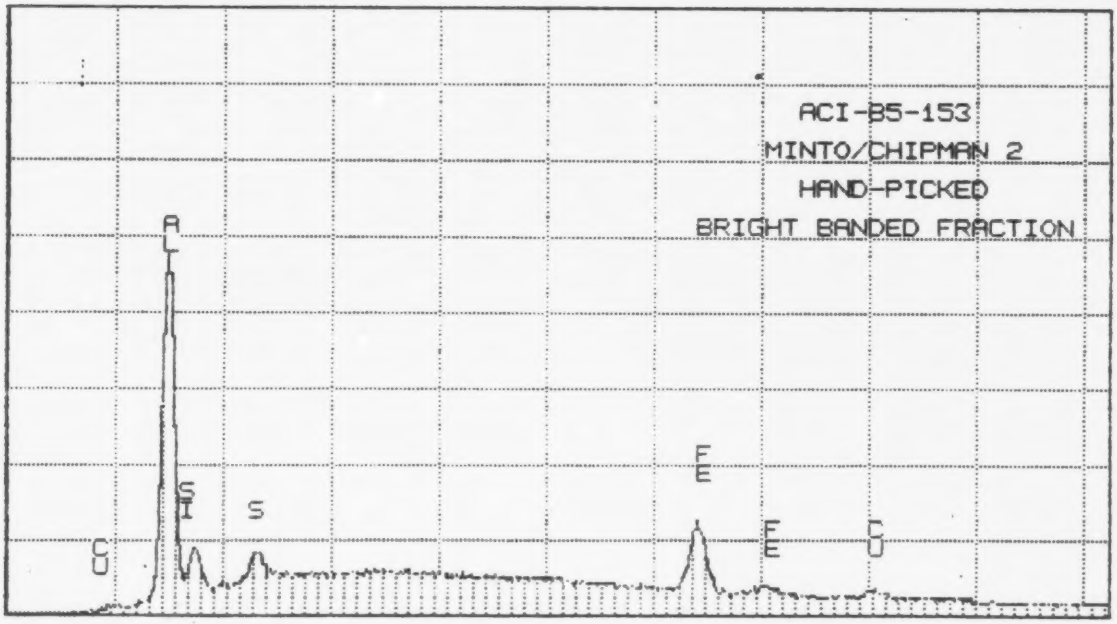
7

0.000 VFS = 1024 10.240

50 MATRIX: PHOTO#1118-03.EDX1

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:32

Cursor: 0.000keV = 0



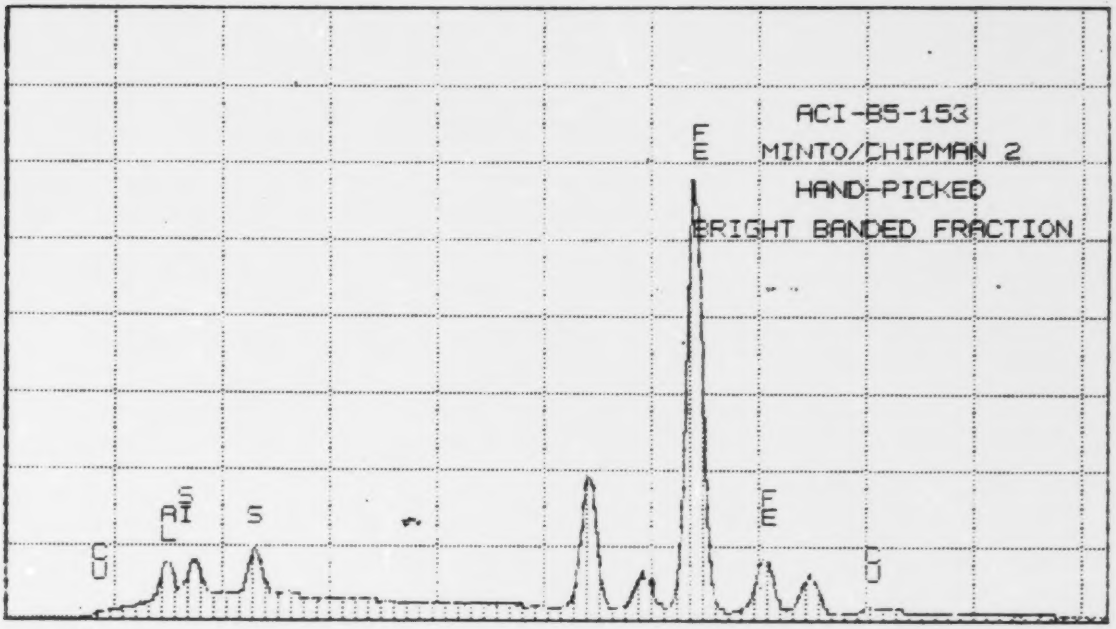
8

0.000 VFS = 2048 10.240

50 CONTAMINANT: PHOTO#1118-04.EDX1

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:35

Cursor: 0.000keV = 0



ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT BANDED FRACTION

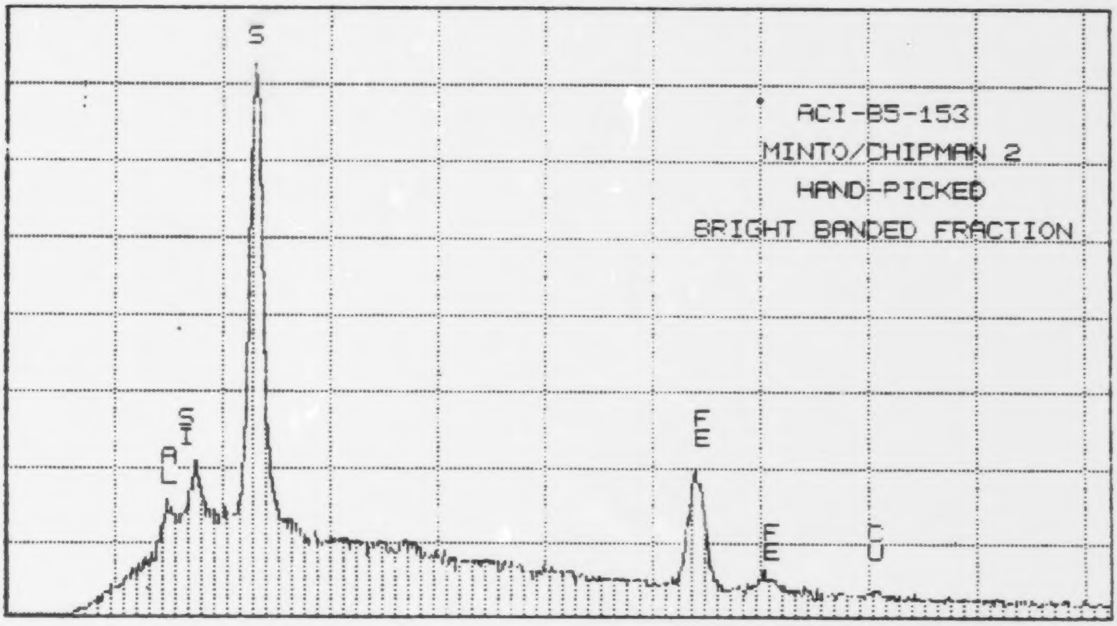
9

0.000 VFS = 8192 10.240

50 CONTAMINANT: PHOTO#1118-04,EDX2

ATLANTIC COAL INSTITUTE TUE 18-NOV-86 11:37

Cursor: 0.000keV = 0



ACI-85-153
MINTO/CHIPMAN 2
HAND-PICKED
BRIGHT BANDED FRACTION

10

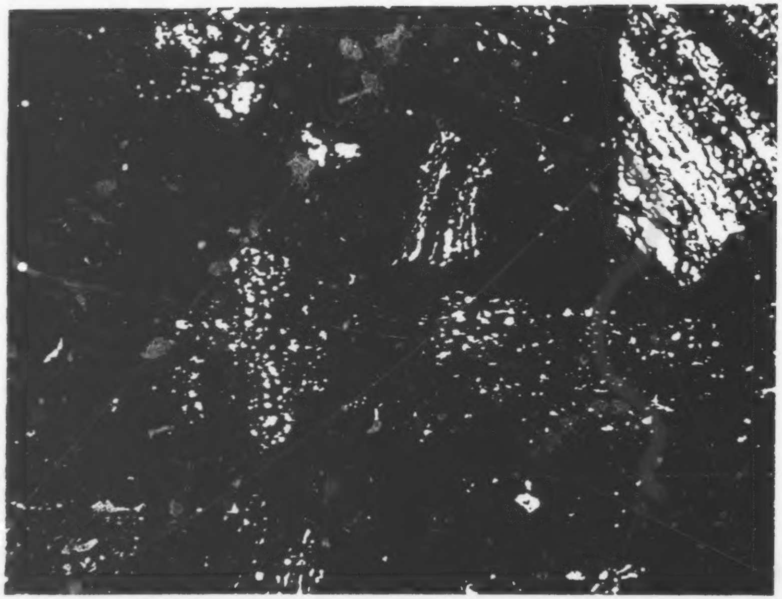
0.000 VFS = 1024 10.240

50 MATRIX: PHOTO#1118-04,EDX3

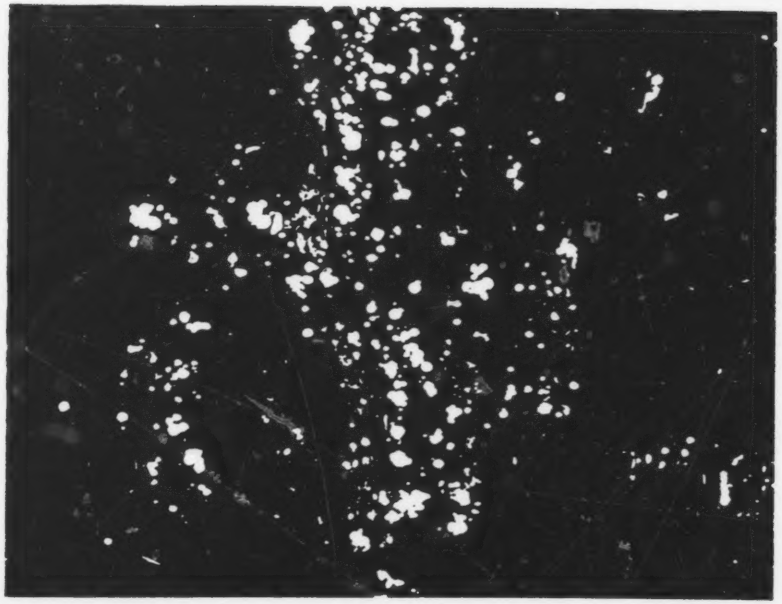
PLATE 8

MINERAL ANALYSIS
Minto/Chipman #2 -1/2" subsample, hand-picked, dull banded fraction

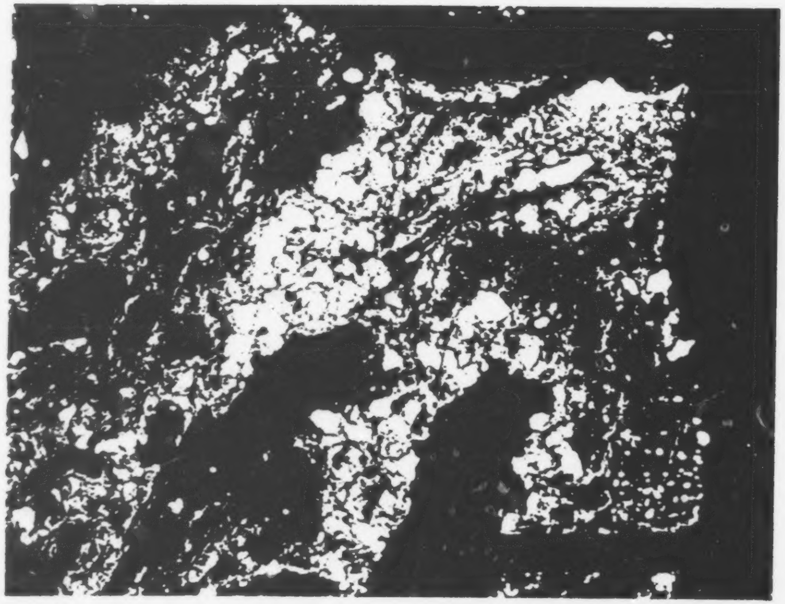
Photo No.	Index No.	Description	Spectra No.
1	1118-10	Area View; 50x; BEI	
2	1118-11	Grain #1; 150x; BEI	1,2,3,4,5,6,7,8,9
3	1118-12	Grain #2, 100x; BEI	10,11,12,13,14
4	1118-13	Grain #3, 100x; BEI	



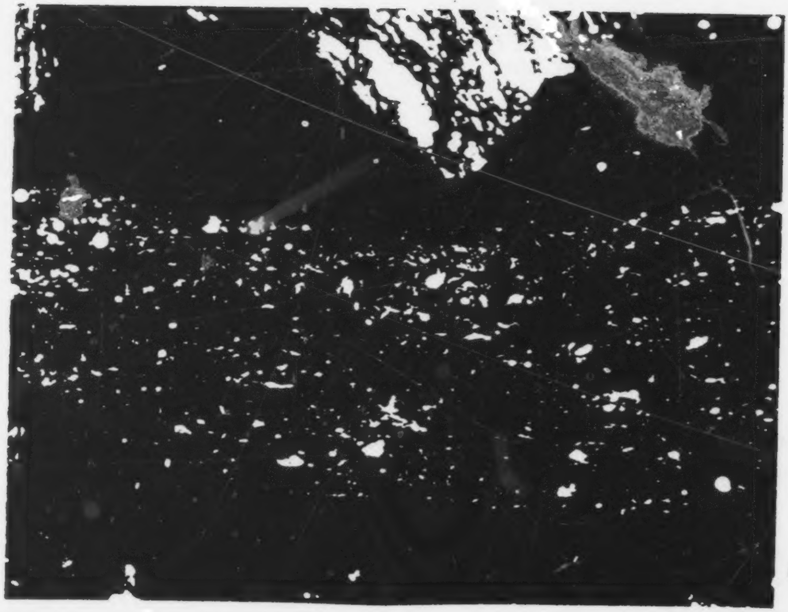
1



2



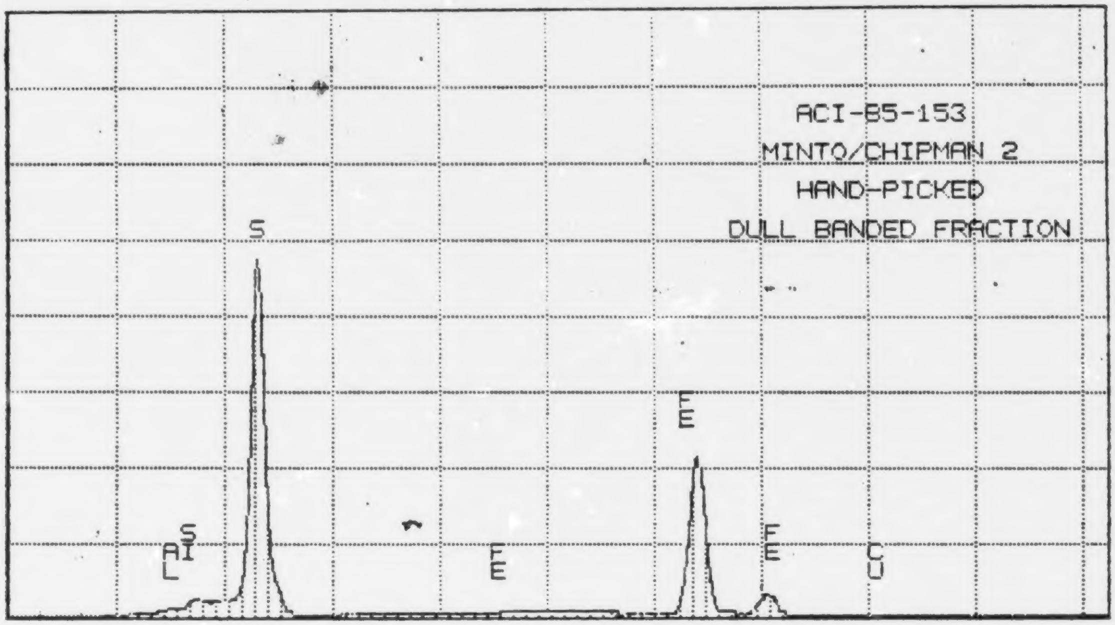
3



4

ATLANTIC COAL INSTITUTE WED 19-NOV-86 10:02

Cursor: 0.000KeV = 0



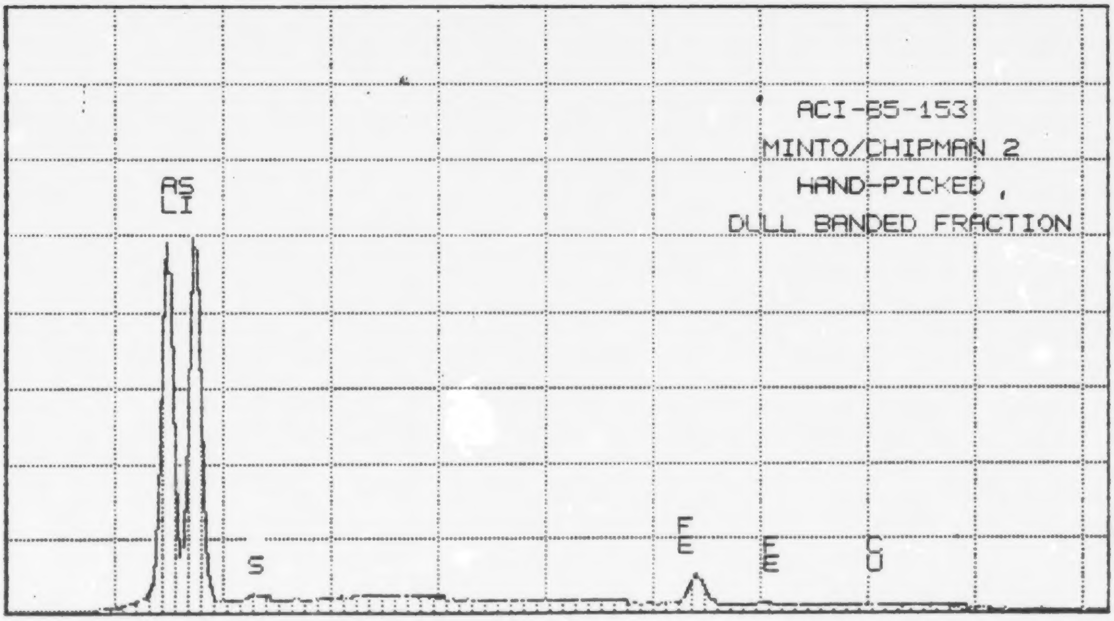
1

0.000 VFS = 32768 10.240

50 MINERAL: **P** PHOTO#1118-11, EDX1

ATLANTIC COAL INSTITUTE WED 19-NOV-86 10:04

Cursor: 0.000KeV = 0

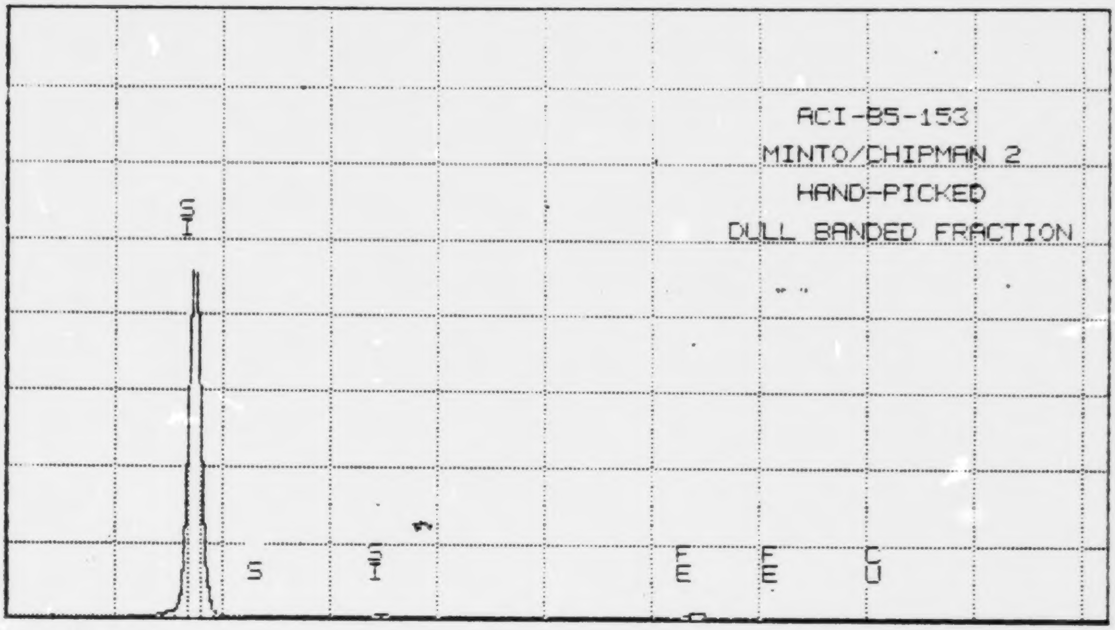


2

0.000 VFS = 8192 10.240

50 MINERAL: **K** PHOTO#1118-11, EDX2

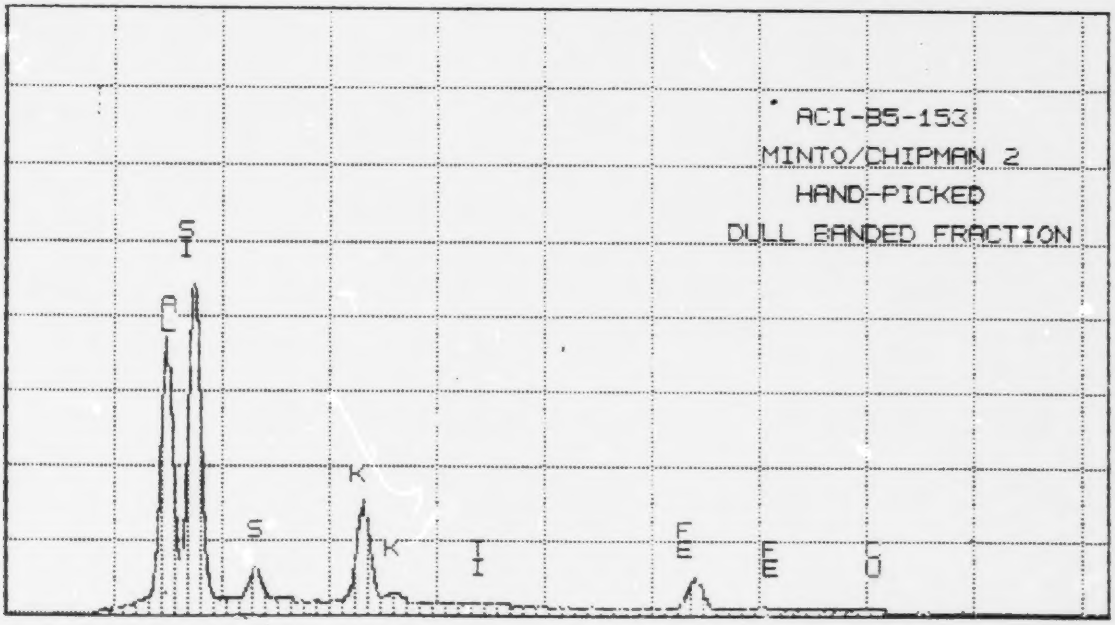
ATLANTIC COAL INSTITUTE WED 19-NOV-86 10:06
Cursor: 0.000keV = 0



3

0.000 VFS = 32768 10.240
50 MINERAL: **Q** PHOTO#1118-11, EDX3

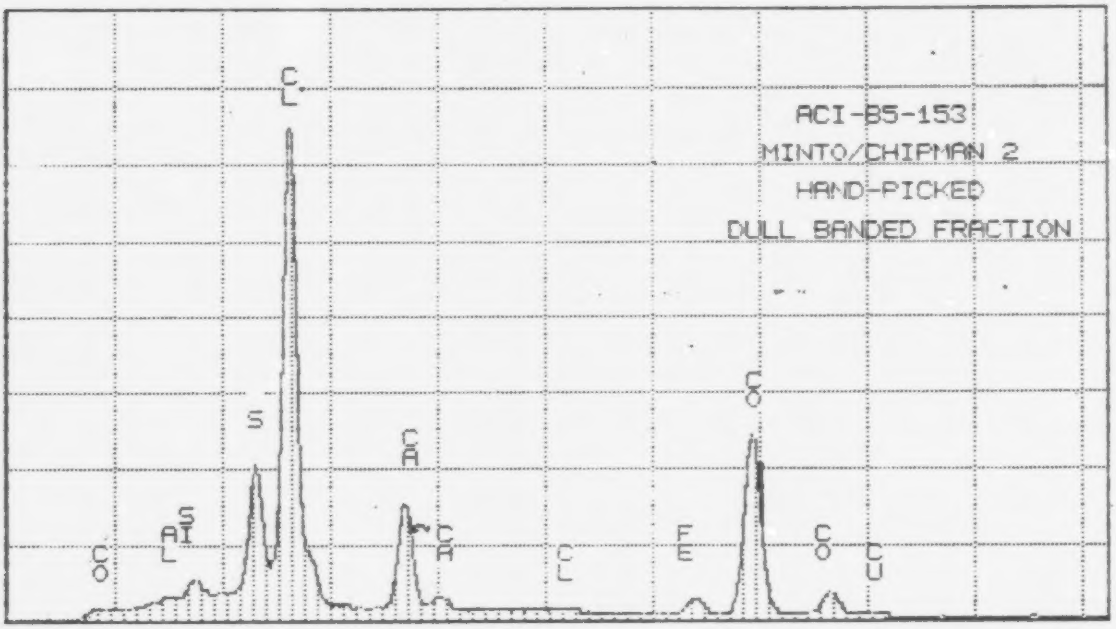
ATLANTIC COAL INSTITUTE WED 19-NOV-86 10:09
Cursor: 0.000keV = 0



4

0.000 VFS = 8192 10.240
50 MINERAL: **I+TI** PHOTO#1118-11, EDX4

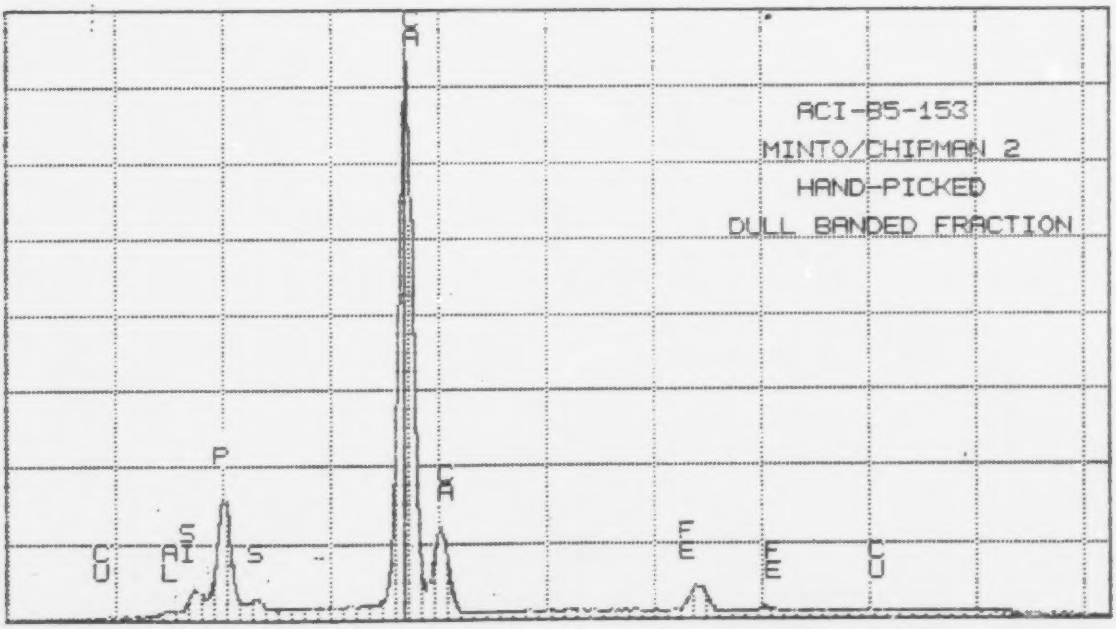
ATLANTIC COAL INSTITUTE WED 19-NOV-86 10:11
Cursor: 0.000keV = 0



0.000 VFS = 16384 10.240
50 CONTAMINANT: PHOTO#1118-11,EDX5

5

ATLANTIC COAL INSTITUTE WED 19-NOV-86 13:47
Cursor: 3.680keV = 7475

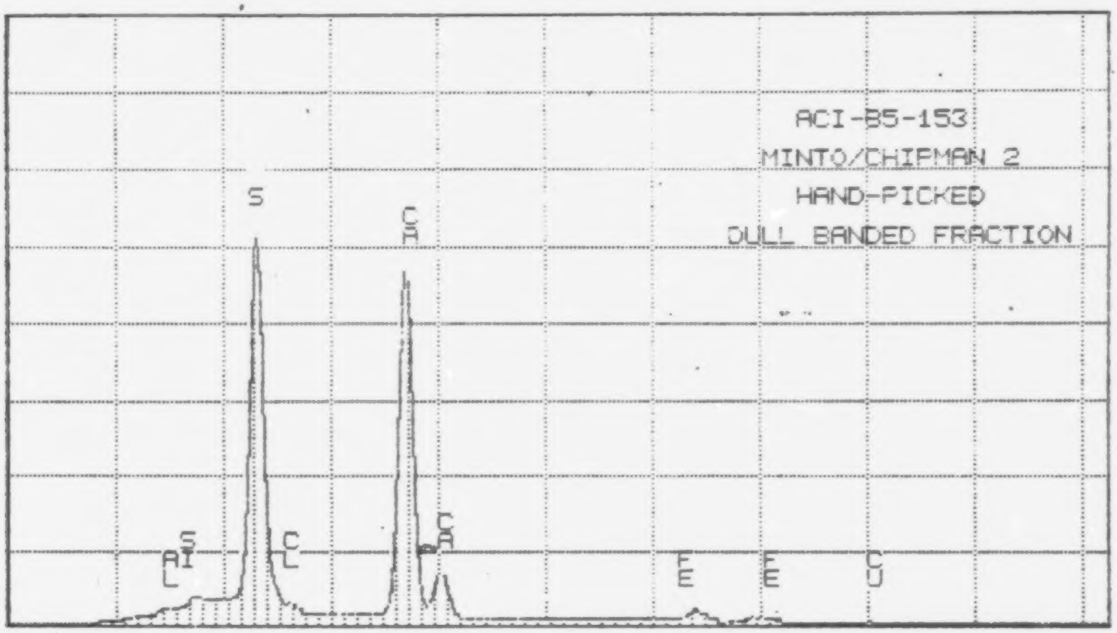


0.000 VFS = 8192 10.240
50 MINERAL: **Ap** PHOTO#1118-11,EDX6

6

ATLANTIC COAL INSTITUTE WED 19-NOV-86 13:51

Cursor: 0.000KeV = 0



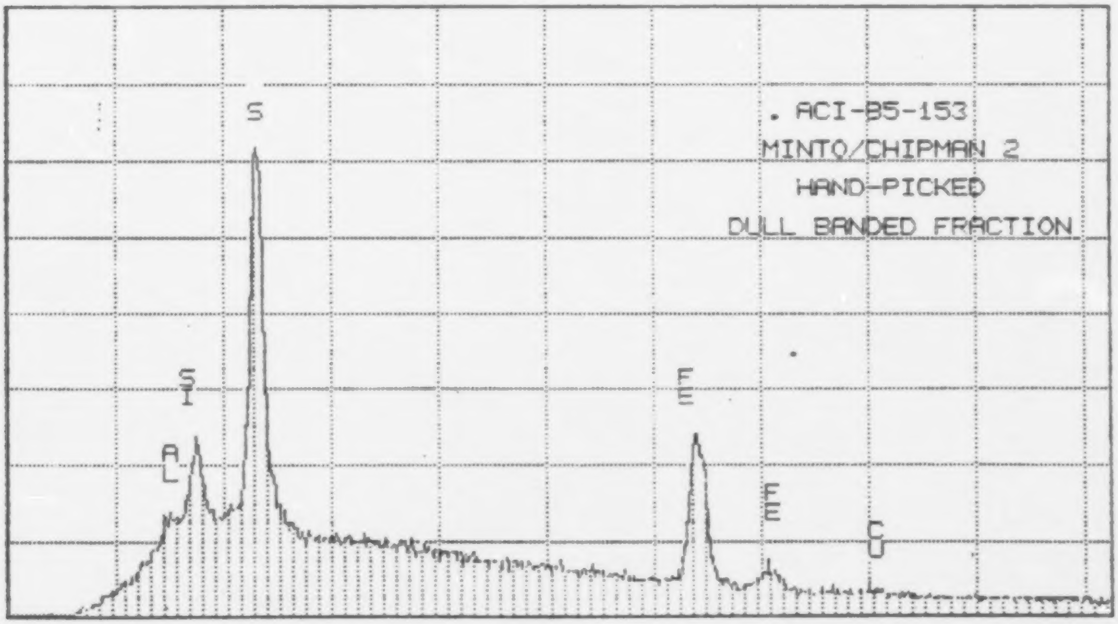
7

0.000 VFS = 16384 10.240

50 CONTAMINANT: PHOTO#1118-11.EDX7

ATLANTIC COAL INSTITUTE WED 19-NOV-86 13:54

Cursor: 0.000KeV = 0



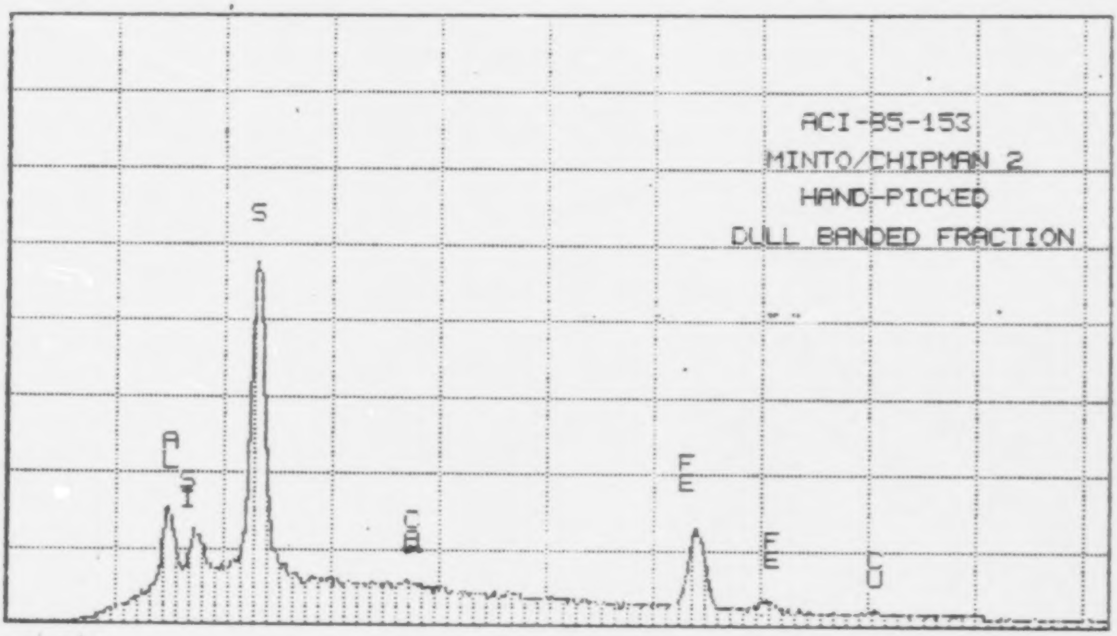
8

0.000 VFS = 1024 10.240

50 MATRIX DK: PHOTO#1118-11.EDX8

ATLANTIC COAL INSTITUTE WED 19-NOV-86 13:57

Cursor: 0.000keV = 0



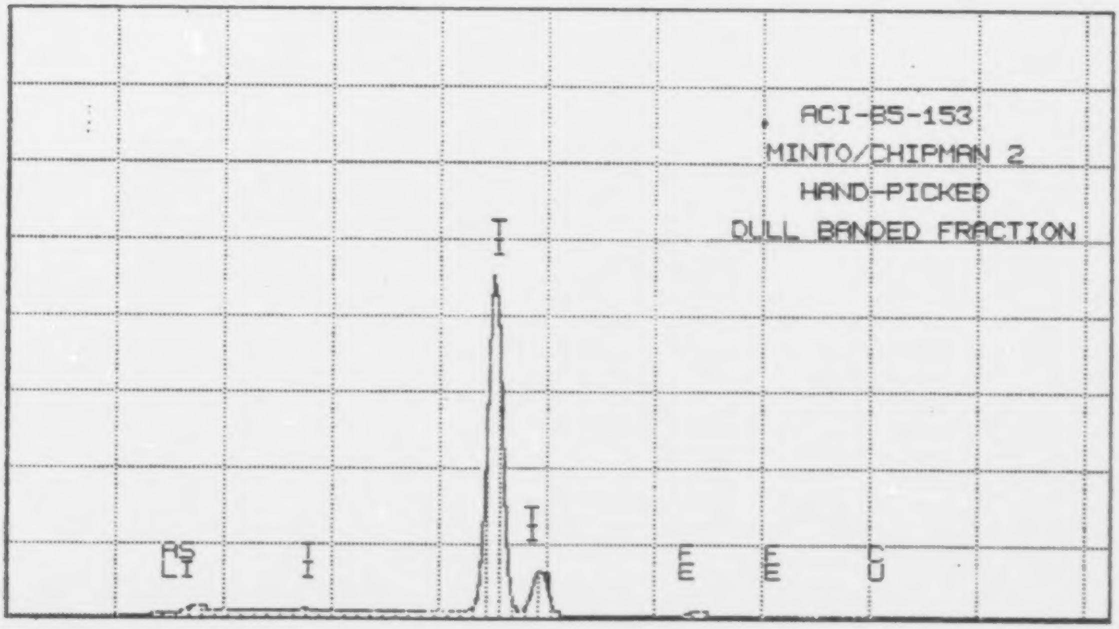
9

0.000 VFS = 2048 10.240

50 MATRIX LT: PHOTO#1118-11,EDX9

ATLANTIC COAL INSTITUTE WED 19-NOV-86 13:59

Cursor: 0.000keV = 0



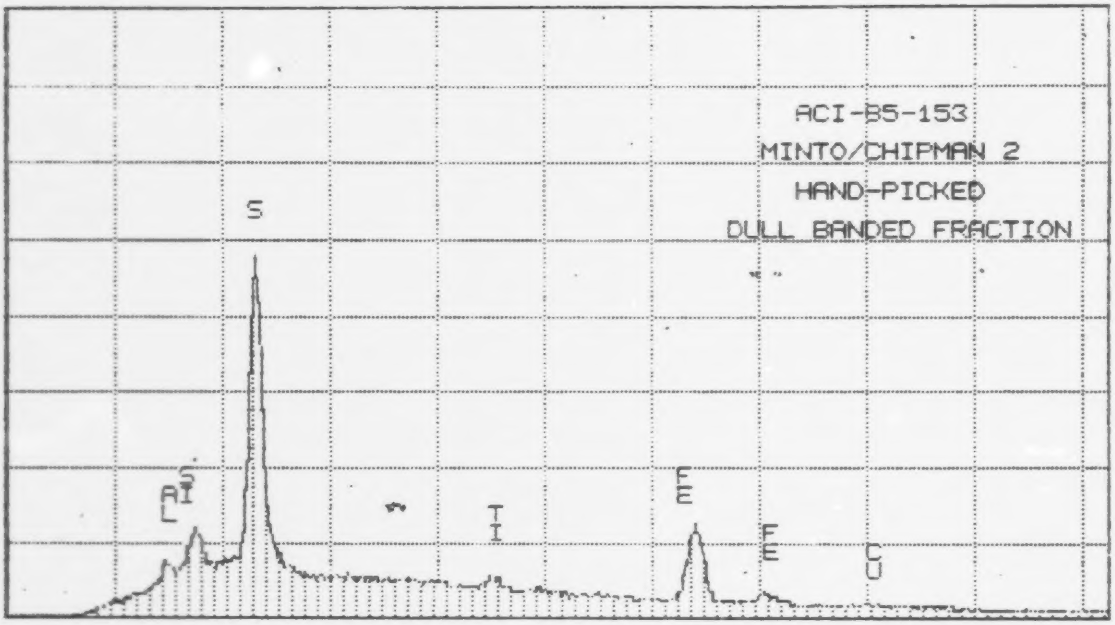
10

0.000 VFS = 32768 10.240

50 MINERAL: **R** PHOTO#1118-12,EDX1

ATLANTIC COAL INSTITUTE WED 19-NOV-86 14:02

Cursor: 0.000keV = 0



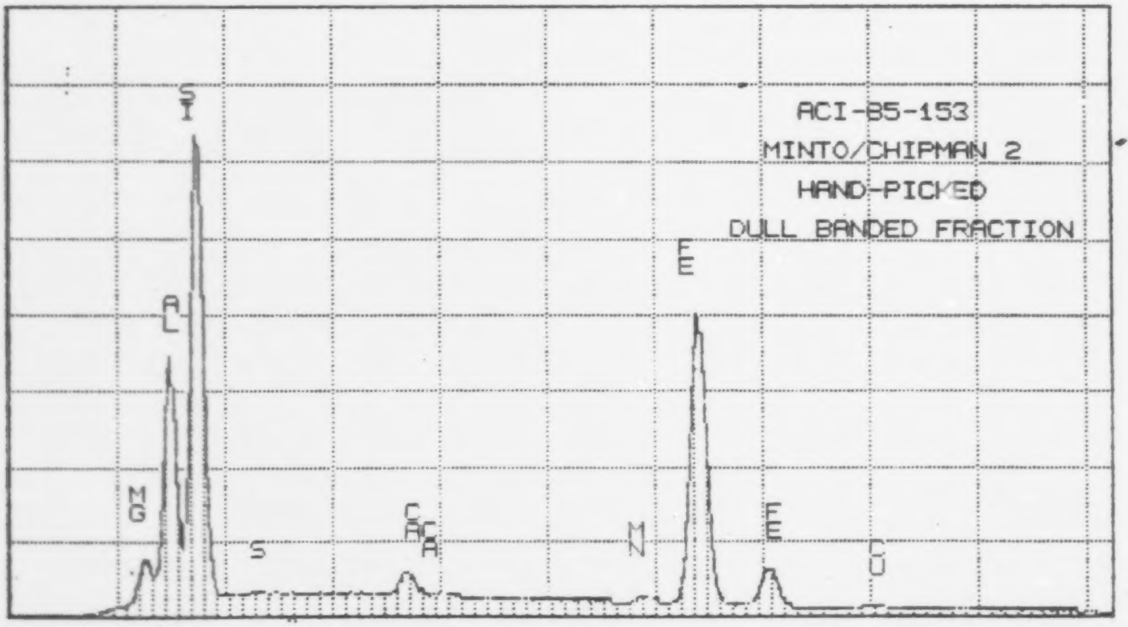
11

0.000 VFS = 2048 10.240

50 MATRIX DK: PHOTO#1118-12,EDX2

ATLANTIC COAL INSTITUTE WED 19-NOV-86 14:06

Cursor: 0.000keV = 0



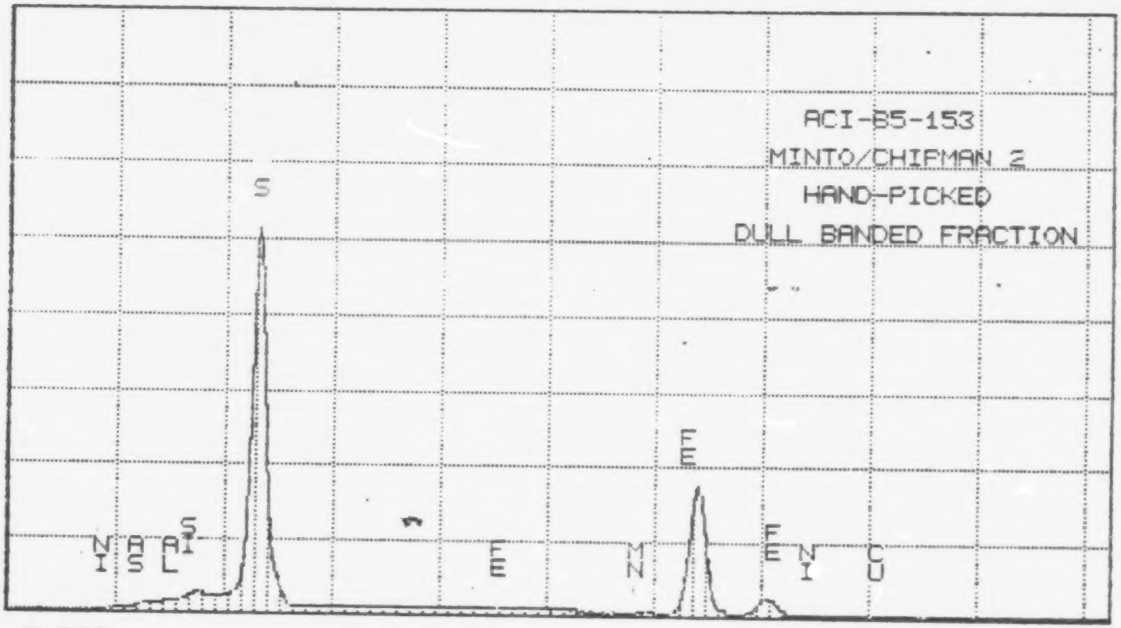
12

0.000 VFS = 8192 10.240

50 MINERAL: **Ch?** PHOTO#1118-12,EDX3

ATLANTIC COAL INSTITUTE   WED 19-NOV-86 14:12

Cursor: 0.000keV = 0



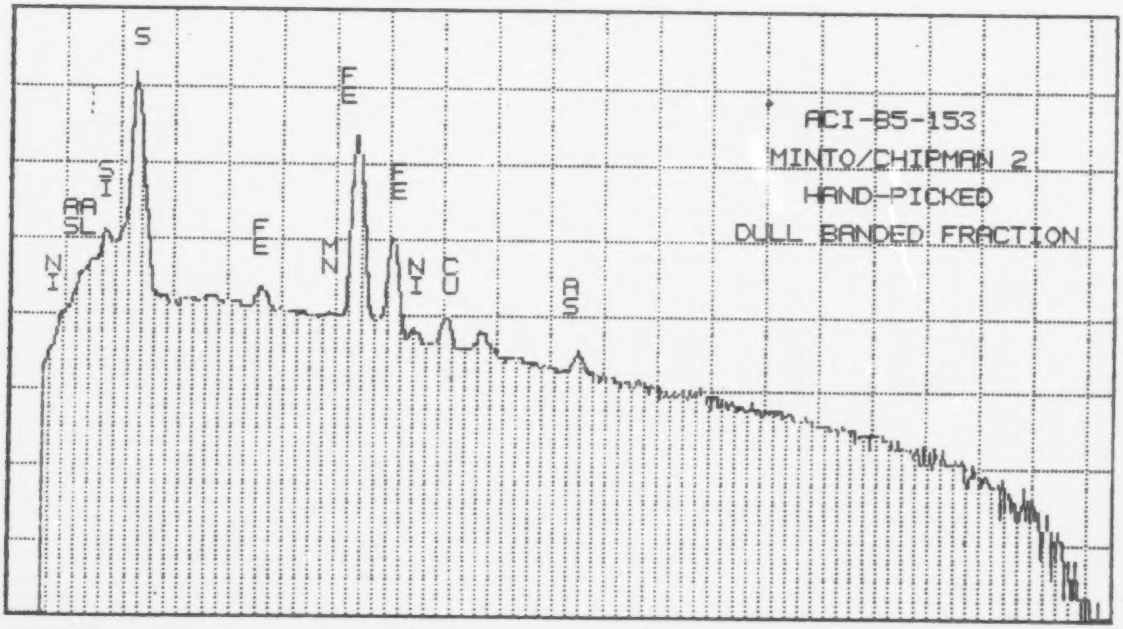
13

0.000   VFS = 32768 10.240

50   MINERAL: **P + As** (see EDX 14) PHOTO#1118-12,EDX4

ATLANTIC COAL INSTITUTE   WED 19-NOV-86 14:14

Cursor: 0.000keV = 0



14

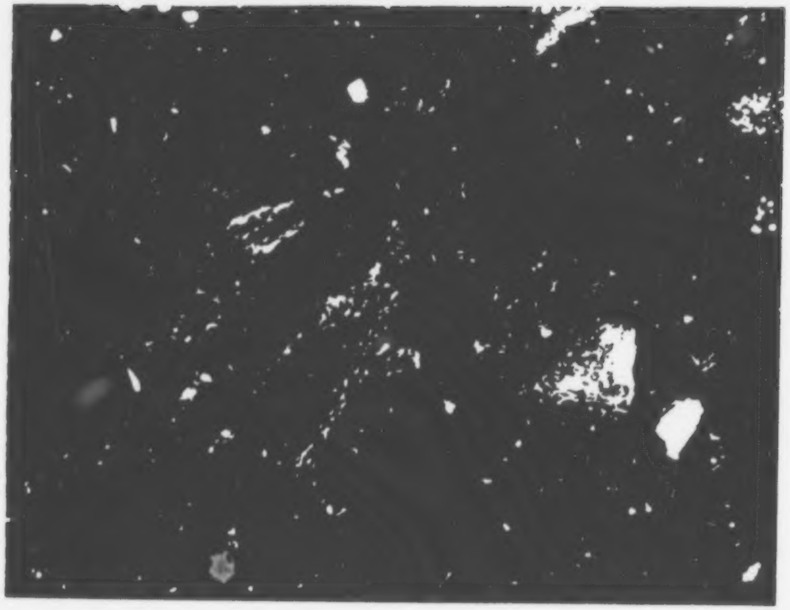
0.000   VFS = LOG 1 20.480

50   MINERAL: **P + As**   PHOTO#1118-12,EDX4

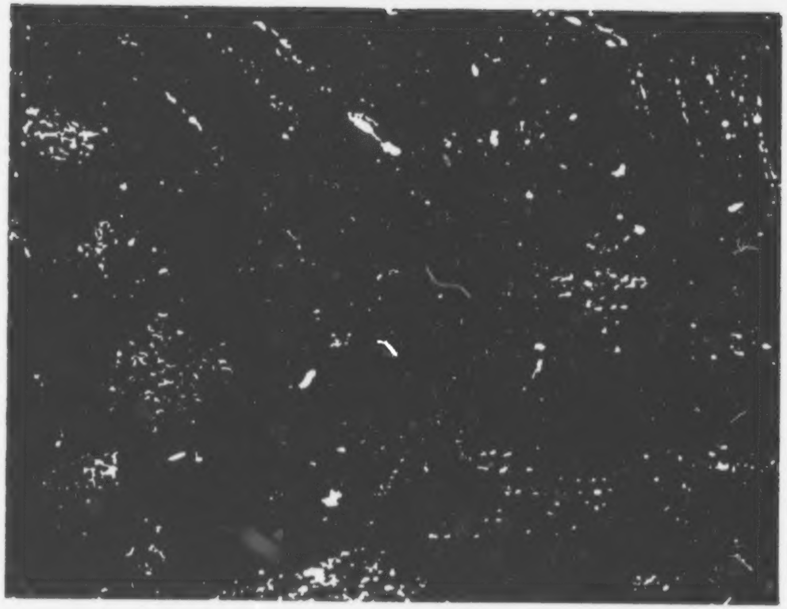
PLATE 9

Particle Recognition and Characterization Program (PRC)

Photo No.	Index No.	Description
1	0828-01	Prince/Hub, PRC area analysed, 50x, BEI
2	1112-04	Minto/Chipman #2, PRC area analysed, 50X, BEI



1



2

```
SUMMARY OF RESULTS

LABEL: 85-153  PRINCE/HUB  BULK COAL
NUMBER OF FRAMES          .     1
NUMBER OF PARTICLES           494
MAGNIFICATION                  50
FIELD WIDTH=            1799.56 um
OFF PARTICLE SPACING=      4.83 um
ON PARTICLE SPACING=       0.43 um
FIELD AREA=            3.23E+06 um^2
TYPE         NAME
                                   AVE.DIA.               MAX        MAX/MIN      AREA       PERIMETE
                                   MICRONS              MICRONS                   uM^2       MICRONS
  0  ALL TYPES               1.06E+01 +-  7.90E+00    1.91E+01    4.12E+00  1.582E+02  5.413E+0
  1  PYRITE                  1.08E+01 +-  7.23E+00    1.78E+01    2.90E+00  1.436E+02  4.886E+0
  2  KAOLINITE               9.22E+00 +-  4.26E+00    1.55E+01    4.79E+00  9.078E+01  4.358E+0
  3  ILLITE                  1.03E+01 +-  3.94E+00    1.90E+01    3.83E+00  1.113E+02  5.215E+0
  4  QUARTZ                  1.10E+01 +-  4.40E+00    1.72E+01    2.35E+00  1.187E+02  4.655E+01
 19  CHALCOPYRITE            7.47E+00 +-  0.00E+00    1.31E+01    3.75E+00  6.208E+01  4.438E+01
 20  ORGANIC SULPHUR         5.27E+00 +-  0.00E+00    7.47E+00    1.88E+00  2.404E+01  1.977E+01
 21  FeS (?)                 9.82E+00 +-  5.36E+00    1.49E+01    2.63E+00  1.057E+02  4.238E+01
 22  ILLITE + Ti             1.11E+01 +-  5.89E+00    2.12E+01    3.96E+00  1.563E+02  5.479E+01
 23  ZIRCON                  6.44E+00 +-  1.34E+00    1.11E+01    3.23E+00  3.901E+01  2.958E+01
 24  POLISH                  1.03E+01 +-  9.05E+00    1.78E+01    3.54E+00  1.486E+02  4.998E+01
 62  NON-INT                 1.51E+01 +-  1.43E+01    2.90E+01    4.84E+00  4.059E+02  8.546E+01
 63  UNKNOWN                 8.94E+00 +-  4.39E+00    1.65E+01    4.80E+00  8.809E+01  4.772E+01

PARTICLE COUNT SUMMARY
TYPE         NAME
                                 NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                     494     100.00        2.41
  1  PYRITE                        108      21.86        0.47
  2  KAOLINITE                      33       6.68        0.09
  3  ILLITE                         42       8.50        0.14
  4  QUARTZ                         15       3.03        0.05
 19  CHALCOPYRITE                    1       0.20        0.00
 20  ORGANIC SULPHUR                 1       0.20        0.00
 21  FeS (?)                        11       2.22        0.03
 22  ILLITE + Ti                    10       2.02        0.04
 23  ZIRCON                          3       0.60        0.00
 24  POLISH                         12       2.42        0.05
 62  NON-INT                        81      16.39        1.01
 63  UNKNOWN                       177      35.82        0.48
```

```
FPC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00      319  64.5 [*********************************
    15.00      103  20.8 [***********
    20.00       39   7.8 [****
    25.00       11   2.2 [**
    30.00       10   2.0 [**
    35.00        3   0.6 [*
    40.00        3   0.6 [*
    45.00        1   0.2 [*
    50.00        0   0.0 [
    55.00        1   0.2 [*
    60.00        2   0.4 [*
    65.00        0   0.0 [
    70.00        1   0.2 [*
    75.00        0   0.0 [
    80.00        0   0.0 [
    85.00        0   0.0 [
    90.00        1   0.2 [*
    95.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       69  63.8 [********************************
    15.00       25  23.1 [************
    20.00        5   4.6 [***
    25.00        3   2.7 [**
    30.00        3   2.7 [**
    35.00        1   0.9 [*
    40.00        1   0.9 [*
    45.00        0   0.0 [
    50.00        0   0.0 [
    55.00        0   0.0 [
    60.00        1   0.9 [*
    65.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       23  69.6 [***********************************
    15.00        7  21.2 [***********
    20.00        1   3.0 [**
    25.00        2   6.0 [****
    30.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       23  54.7 [****************************
    15.00       12  28.5 [***************
    20.00        7  16.6 [*********
    25.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        8  53.3 [***************************
    15.00        4  26.6 [**************
    20.00        3  20.0 [***********

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        7  63.6 [********************************
    15.00        3  27.2 [**************
    20.00        0   0.0 [
    25.00        1   9.0 [*****
    30.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        6  60.0 [*******************************
    15.00        3  30.0 [****************
    20.00        0   0.0 [
    25.00        0   0.0 [
    30.00        1  10.0 [******

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        3 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        9  75.0 [**************************************
    15.00        2  16.6 [*********
    20.00        0   0.0 [
    25.00        0   0.0 [
    30.00        0   0.0 [
    35.00        0   0.0 [
    40.00        1   8.3 [*****
    45.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      39  48.1 [*************************
    15.00      16  19.7 [**********
    20.00      12  14.8 [********
    25.00       3   3.7 [**
    30.00       4   4.9 [***
    35.00       1   1.2 [*
    40.00       1   1.2 [*
    45.00       1   1.2 [*
    50.00       0   0.0 [
    55.00       1   1.2 [*
    60.00       1   1.2 [*
    65.00       0   0.0 [
    70.00       1   1.2 [*
    75.00       0   0.0 [
    80.00       0   0.0 [
    85.00       0   0.0 [
    90.00       1   1.2 [*
    95.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     130  73.4 [*************************************
    15.00      31  17.5 [*********
    20.00      11   6.2 [****
    25.00       2   1.1 [*
    30.00       2   1.1 [*
    35.00       1   0.5 [*
    40.00       0   0.0 [
PRC: REPORT


SUMMARY OF RESULTS

LABEL: 85-153  MINTO/CHIP.2   BULK COAL
NUMBER OF FRAMES              1
NUMBER OF PARTICLES         752
MAGNIFICATION                50
FIELD WIDTH=          1799.56 um
OFF PARTICLE SPACING=    4.83 um
ON PARTICLE SPACING=     0.43 um
FIELD AREA=          3.23E+06 um^2
TYPE          NAME                 AVE.DIA.              .MAX       MAX/MIN     AREA      PERIMET
                                   MICRONS              MICRONS                 uM^2      MICRONS
  0  ALL TYPES            9.53E+00 +-  5.01E+00    1.58E+01   2.97E+00  1.028E+02  4.382E+
  1  PYRITE               9.11E+00 +-  4.29E+00    1.47E+01   2.68E+00  9.089E+01  4.046E+
  2  KAOLINITE            8.15E+00 +-  2.73E+00    1.39E+01   3.01E+00  6.473E+01  3.941E+
  3  ILLITE               9.67E+00 +-  5.59E+00    1.64E+01   3.12E+00  1.069E+02  4.516E+
  4  QUARTZ               1.11E+01 +-  7.09E+00    1.80E+01   2.57E+00  1.527E+02  4.722E+
  5  SIDERITE             1.07E+01 +-  1.55E+00    1.42E+01   1.64E+00  9.853E+01  3.911E+
  6  CALCITE              1.80E+01 +-  0.00E+00    2.24E+01   2.21E+00  2.659E+02  7.426E+
 14  RUTILE               8.34E+00 +-  0.00E+00    1.14E+01   2.16E+00  5.977E+01  3.339E+
 21  FeS (?)              1.20E+01 +-  6.38E+00    1.94E+01   2.88E+00  1.621E+02  5.410E+
 22  ILLITE + Ti          8.45E+00 +-  1.84E+00    1.73E+01   5.16E+00  6.266E+01  5.207E+
 23  ZIRCON               1.05E+01 +-  0.00E+00    1.36E+01   1.72E+00  8.815E+01  4.350E+
 24  POLISH               1.25E+01 +-  4.17E+00    2.64E+01   4.42E+00  1.482E+02  7.177E+
 62  NON-INT              1.01E+01 +-  5.10E+00    2.26E+01   5.57E+00  1.373E+02  6.418E+
 63  UNKNOWN              1.03E+01 +-  6.77E+00    1.79E+01   3.73E+00  1.333E+02  4.987E+

PARTICLE COUNT SUMMARY
TYPE          NAME                NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                      752     100.00       2.38
  1  PYRITE                         373      49.60       1.04
  2  KAOLINITE                      121      16.09       0.24
  3  ILLITE                          39       5.18       0.12
  4  QUARTZ                          54       7.18       0.25
  5  SIDERITE                         2       0.26       0.00
  6  CALCITE                          1       0.13       0.00
 14  RUTILE                           1       0.13       0.00
 21  FeS (?)                         48       6.38       0.24
 22  ILLITE + Ti                      4       0.53       0.00
 23  ZIRCON                           1       0.13       0.00
 24  POLISH                           6       0.79       0.02
 62  NON-INT                         16       2.12       0.06
 63  UNKNOWN                         86      11.43       0.35
```

```
PRC: HISTOGRAM


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     513  68.8 [***********************************
    15.00     164  21.8 [***********
    20.00      37   4.9 [***
    25.00      17   2.2 [**
    30.00       3   0.3 [*
    35.00       8   1.0 [*
    40.00       4   0.5 [*
    45.00       1   0.1 [*
    50.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     266  71.3 [************************************
    15.00      81  21.7 [***********
    20.00      14   3.7 [**
    25.00       7   1.8 [*
    30.00       2   0.5 [*
    35.00       2   0.5 [*
    40.00       0   0.0 [
    45.00       1   0.2 [*
    50.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      95  78.5 [****************************************
    15.00      21  17.3 [*********
    20.00       5   4.1 [***
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      27  69.2 [***********************************
    15.00       9  23.0 [************
    20.00       1   2.5 [**
    25.00       1   2.5 [**
    30.00       0   0.0 [
    35.00       0   0.0 [
    40.00       1   2.5 [**
    45.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      34  62.9 [********************************
    15.00      12  22.2 [************
    20.00       2   3.7 [**
    25.00       2   3.7 [**
    30.00       0   0.0 [
    35.00       4   7.4 [****
    40.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1  50.0 [**************************
    15.00        1  50.0 [**************************


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        0   0.0 [
    15.00        0   0.0 [
    20.00        1 100.0 [***************************************************


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1 100.0 [***************************************************


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       19  39.5 [********************
    15.00       18  37.5 [*******************
    20.00        5  10.4 [******
    25.00        4   8.3 [*****
    30.00        1   2.0 [**
    35.00        1   2.0 [**
    40.00        0   0.0 [


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        4 100.0 [***************************************************


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        0   0.0 [
    15.00        1 100.0 [***************************************************


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1  16.6 [*********
    15.00        4  66.6 [**********************************
    20.00        1  16.6 [*********
    25.00        0   0.0 [

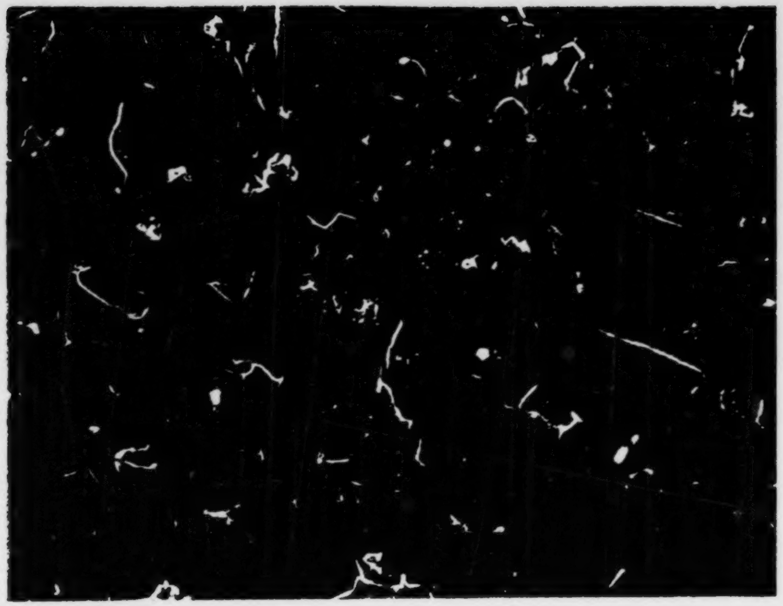

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       13  81.2 [*****************************************
    15.00        0   0.0 [
    20.00        1   6.2 [****
    25.00        2  12.5 [*******
    30.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)   NO.  %    00---10---20---30---40---50---60---70---80---90---100
      5.00      0   0.0 [
     10.00     57  66.2 [**********************************
     15.00     17  19.7 [**********
     20.00      7   8.1 [*****
     25.00      1   1.1 [*
     30.00      0   0.0 [
     35.00      1   1.1 [*
     40.00      3   3.4 [**
     45.00      0   0.0 [
```

PLATE 10

Particle Recognition and Characterization Program (PRC)

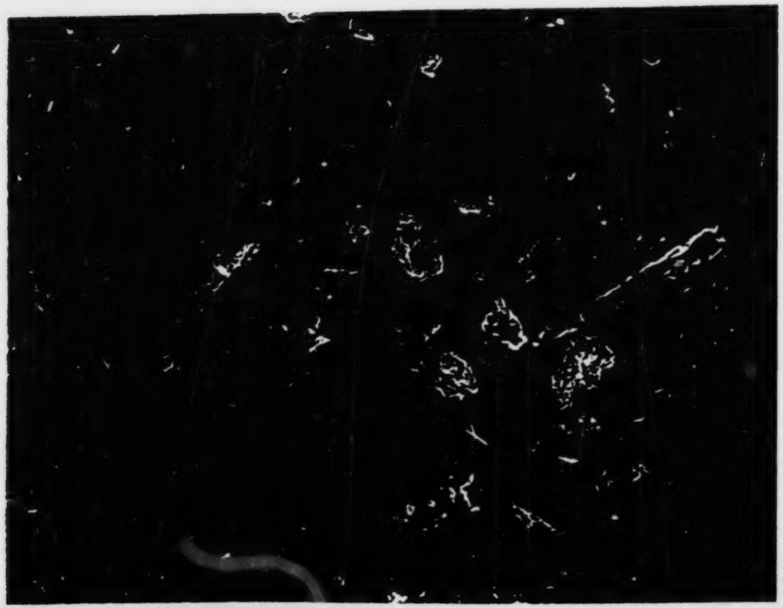
-42 mesh to +100 mesh sieve fraction; float sink analysis:
1.30 f; 1.30 s; 1.35 s; 1.40 s; 1.45 s; 1.50 s; 1.60 s; 1.70 s; 1.80 s; 2.00 s

Photo No.	Index No.	Description
1	0825-01	Prince/Hub; 1.30 float fraction; PRC area analysed; 50x; SEI
2	0825-02	Prince/Hub; same view as P#1, BEI
3	0827-02	Prince/Hub; 1.50 sink fraction; PRC area analysed, 50x; SEI
4	0827-01	Prince/Hub; same view as P#3, BEI
5	0827-03	Prince/Hub; 1.50 sink fraction; enlargement of grain in center of P#3; 500x; BEI
6	1113-01	Prince/Hub; 1.80 sink fraction; PRC area analysed 50x; BEI
7	1008-01	Minto/Chipman #2; 1.50 sink fraction; PRC area analysed; 50x; BEI
8	1112-05	Minto/Chipman #2; 1.80 sink fraction PRC area analysed; 50x; BEI



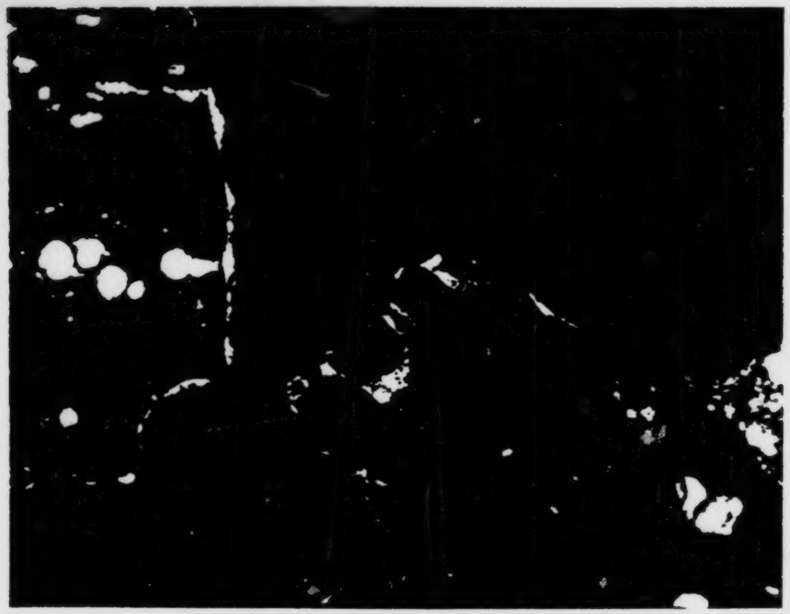
1

2

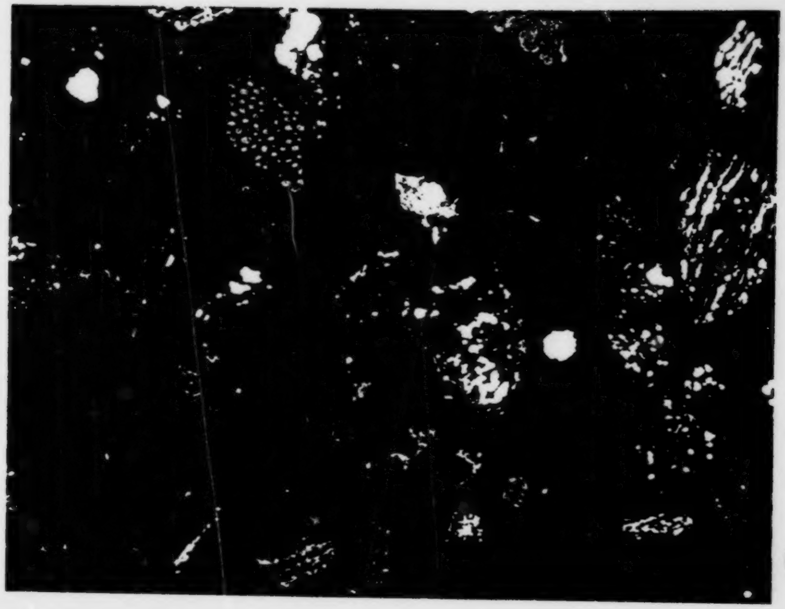


3

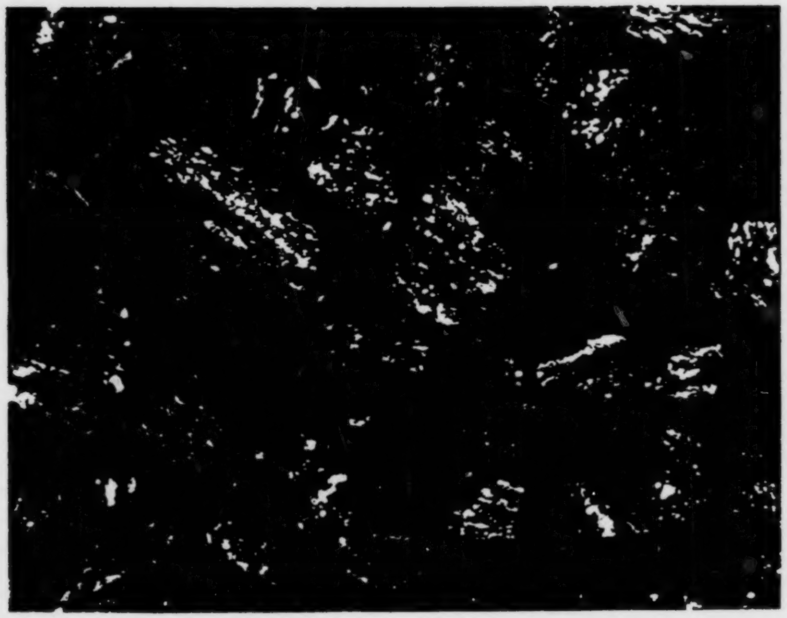
4



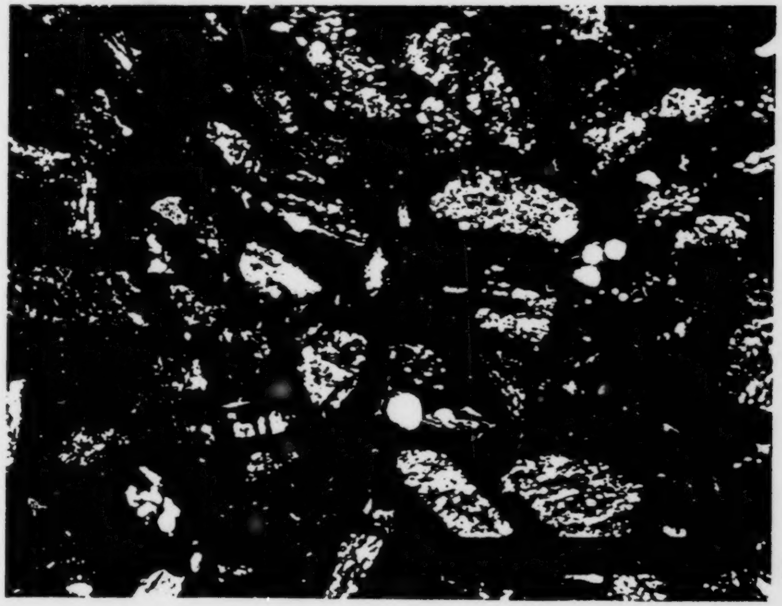
5



6



7



8

```
PRC: REP


SUMMARY OF RESULTS

LABEL: 85-197  PRINCE/HUB  1.3 float
NUMBER OF FRAMES            2
NUMBER OF PARTICLES       452
MAGNIFICATION              50
FIELD WIDTH=          1799.56 um
OFF PARTICLE SPACING=    4.83 um
ON PARTICLE SPACING=     0.43 um
FIELD AREA=          3.23E+06 um^2
TYPE          NAME                     AVE.DIA.              MAX        MAX/MIN      AREA      PERIMETER
                                       MICRONS               MICRONS                 uM^2      MICRONS
  0  ALL TYPES                8.84E+00 +-  4.16E+00   1.59E+01    3.49E+00   8.399E+01   4.336E+01
  1  PYRITE                   9.74E+00 +-  5.01E+00   1.49E+01    2.45E+00   1.007E+02   4.102E+01
  2  KAOLINITE                7.58E+00 +-  2.54E+00   1.24E+01    2.64E+00   5.752E+01   3.515E+01
  3  ILLITE                   9.22E+00 +-  4.04E+00   1.71E+01    3.71E+00   8.892E+01   4.537E+01
  4  QUARTZ                   8.25E+00 +-  4.12E+00   1.25E+01    2.40E+00   7.299E+01   3.431E+01
 11  GYPSUM                   5.27E+00 +-  0.00E+00   7.47E+00    1.54E+00   2.539E+01   1.977E+01
 14  RUTILE                   9.22E+00 +-  0.00E+00   1.93E+01    3.38E+00   6.382E+01   5.976E+01
 19  CHALCOPYRITE             2.24E+01 +-  0.00E+00   3.33E+01    2.30E+00   4.066E+02   8.876E+01
 21  FeS (?)                  1.96E+01 +-  9.79E+00   2.66E+01    1.99E+00   3.887E+02   8.009E+01
 22  ILLITE + Ti              1.02E+01 +-  3.58E+00   1.90E+01    3.72E+00   1.043E+02   5.181E+01
 23  ZIRCON                   6.88E+00 +-  1.41E+00   1.42E+01    4.67E+00   4.966E+01   4.233E+01
 24  POLISH                   7.92E+00 +-  3.11E+00   1.55E+01    4.20E+00   6.703E+01   4.091E+01
 62  NON-INT                  8.97E+00 +-  3.55E+00   1.52E+01    3.20E+00   8.242E+01   4.492E+01
 63  UNKNOWN                  8.22E+00 +-  3.02E+00   1.65E+01    4.13E+00   6.970E+01   4.439E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                   NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                         452     100.00      0.58
  1  PYRITE                             77      17.03      0.11
  2  KAOLINITE                          30       6.63      0.02
  3  ILLITE                             47      10.39      0.06
  4  QUARTZ                             23       5.08      0.02
 11  GYFSUM                              1       0.22      0.00
 14  RUTILE                              1       0.22      0.00
 19  CHALCOPYRITE                        1       0.22      0.00
 21  FeS (?)                             8       1.76      0.04
 22  ILLITE + Ti                        10       2.21      0.01
 23  ZIRCON                              3       0.66      0.00
 24  POLISH                             44       9.73      0.04
 62  NON-INT                            35       7.74      0.04
 63  UNKNOWN                           172      38.05      0.18
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:    0   NAME: ALL TYPES
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     333  73.6 [*************************************
    15.00      85  18.8 [**********
    20.00      22   4.8 [***
    25.00       8   1.7 [*
    30.00       2   0.4 [*
    35.00       2   0.4 [*
    40.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:    1   NAME: PYRITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      52  67.5 [**********************************
    15.00      17  22.0 [************
    20.00       5   6.4 [****
    25.00       2   2.5 [**
    30.00       0   0.0 [
    35.00       1   1.2 [*
    40.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:    2   NAME: KAOLINITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      25  83.3 [******************************************
    15.00       5  16.6 [*********
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:    3   NAME: ILLITE
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      30  63.8 [********************************
    15.00      12  25.5 [*************
    20.00       4   8.5 [*****
    25.00       1   2.1 [**
    30.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:    4   NAME: QUARTZ
BIN MAX(uM)    NO.   %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      19  82.6 [******************************************
    15.00       2   8.6 [*****
    20.00       1   4.3 [***
    25.00       1   4.3 [***
    30.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       0   0.0 [
    20.00       0   0.0 [
    25.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2  25.0 [*************
    15.00       1  12.5 [*******
    20.00       1  12.5 [*******
    25.00       1  12.5 [*******
    30.00       2  25.0 [*************
    35.00       1  12.5 [*******
    40.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       4  40.0 [********************
    15.00       5  50.0 [*************************
    20.00       1  10.0 [******

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       3 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      38  86.3 [********************************************
    15.00       4   9.0 [*****
    20.00       1   2.2 [**
    25.00       1   2.2 [**
    30.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      26  74.2 [**************************************
    15.00       7  20.0 [***********
    20.00       2   5.7 [***
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     132  76.7 [***************************************
    15.00      32  18.6 [**********
    20.00       7   4.0 [***
    25.00       1   0.5 [*
    30.00       0   0.0 [
PRC: REP


SUMMARY OF RESULTS

LABEL: 85-197  PRINCE/HUB  1.5 sink
NUMBER OF FRAMES               1
NUMBER OF PARTICLES       1450
MAGNIFICATION               50
FIELD WIDTH=           1799.56 um
OFF PARTICLE SPACING=     4.83 um
ON PARTICLE SPACING=      0.43 um
FIELD AREA=           3.23E+06 um^2
TYPE          NAME                  AVE.DIA.               MAX       MAX/MIN      AREA      PERIMETE
                                     MICRONS             MICRONS                  uM^2      MICRONS
  0  ALL TYPES               1.21E+01 +-  8.25E+00    2.42E+01    4.58E+00  1.925E+02  6.782E+0
  1  PYRITE                  1.18E+01 +-  7.56E+00    2.02E+01    3.14E+00  1.715E+02  5.508E+0
  2  KAOLINITE               1.12E+01 +-  6.62E+00    2.05E+01    3.57E+00  1.488E+02  5.713E+0
  3  ILLITE                  1.55E+01 +-  1.20E+01    3.38E+01    4.83E+00  3.375E+02  9.032E+0
  4  QUARTZ                  1.10E+01 +-  1.18E+01    2.00E+01    3.48E+00  1.985E+02  5.590E+0
  5  SIDERITE                1.66E+01 +-  0.00E+00    2.02E+01    1.31E+00  2.225E+02  5.712E+0
 11  GYPSUM                  7.47E+00 +-  0.00E+00    1.05E+01    2.18E+00  5.030E+01  2.856E+0
 16  MONAZITE                7.03E+00 +-  1.24E+00    1.07E+01    3.18E+00  4.953E+01  4.086E+0
 18  SPHALERITE              5.27E+00 +-  0.00E+00    1.09E+01    3.12E+00  2.858E+01  2.636E+0
 20  ORGANIC SULPHUR         1.31E+01 +-  0.00E+00    2.63E+01    3.75E+00  1.651E+02  6.284E+0
 21  FeS (?)                 1.83E+01 +-  6.93E+00    2.83E+01    2.53E+00  3.233E+02  8.210E+0
 22  ILLITE + Ti             1.12E+01 +-  4.79E+00    2.21E+01    4.34E+00  1.313E+02  6.159E+0
 23  ZIRCON                  6.59E+00 +-  0.00E+00    1.45E+01    3.66E+00  4.470E+01  4.877E+0
 24  POLISH                  8.90E+00 +-  3.33E+00    1.71E+01    5.84E+00  8.079E+01  5.096E+0
 62  NON-INT                 1.31E+01 +-  8.27E+00    2.58E+01    5.64E+00  2.225E+02  7.769E+0
 63  UNKNOWN                 1.15E+01 +-  7.56E+00    2.45E+01    5.05E+00  1.734E+02  6.836E+0

PARTICLE COUNT SUMMARY
TYPE          NAME                  NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                       1450     100.00         8.61
  1  PYRITE                           201      13.86         1.06
  2  KAOLINITE                        148      10.20         0.68
  3  ILLITE                           140       9.65         1.45
  4  QUARTZ                            37       2.55         0.22
  5  SIDERITE                           1       0.06         0.00
 11  GYPSUM                             1       0.06         0.00
 16  MONAZITE                           2       0.13         0.00
 18  SPHALERITE                         1       0.06         0.00
 20  ORGANIC SULPHUR                    1       0.06         0.00
 21  FeS (?)                           34       2.34         0.33
 22  ILLITE + Ti                       13       0.89         0.05
 23  ZIRCON                             1       0.06         0.00
 24  POLISH                            37       2.55         0.09
 62  NON-INT                          147      10.13         1.01
 63  UNKNOWN                          686      47.31         3.67
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00      752  51.8 [**************************
    15.00      387  26.6 [**************
    20.00      138   9.5 [*****
    25.00       73   5.0 [***
    30.00       39   2.6 [**
    35.00       22   1.5 [*
    40.00       12   0.8 [*
    45.00       11   0.7 [*
    50.00        7   0.4 [*
    55.00        5   0.3 [*
    60.00        0   0.0 [
    65.00        0   0.0 [
    70.00        2   0.1 [*
    75.00        0   0.0 [
    80.00        2   0.1 [*
    85.00        0   0.0 [


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00      101  50.2 [**************************
    15.00       65  32.3 [*****************
    20.00       15   7.4 [****
    25.00        9   4.4 [***
    30.00        1   0.4 [*
    35.00        6   2.9 [**
    40.00        1   0.4 [*
    45.00        1   0.4 [*
    50.00        0   0.0 [
    55.00        2   0.9 [*
    60.00        0   0.0 [


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       81  54.7 [****************************
    15.00       39  26.3 [**************
    20.00       16  10.8 [******
    25.00        5   3.3 [**
    30.00        3   2.0 [**
    35.00        3   2.0 [**
    40.00        0   0.0 [
    45.00        0   0.0 [
    50.00        1   0.6 [*
    55.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      62  44.2 [***********************
    15.00      26  18.5 [**********
    20.00      21  15.0 [********
    25.00       8   5.7 [***
    30.00       9   6.4 [****
    35.00       3   2.1 [**
    40.00       3   2.1 [**
    45.00       1   0.7 [*
    50.00       4   2.8 [**
    55.00       1   0.7 [*
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       2   1.4 [*
    75.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      27  72.9 [*************************************
    15.00       6  16.2 [*********
    20.00       2   5.4 [***
    25.00       1   2.7 [**
    30.00       0   0.0 [
    35.00       0   0.0 [
    40.00       0   0.0 [
    45.00       0   0.0 [
    50.00       0   0.0 [
    55.00       0   0.0 [
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       1   2.7 [**
    85.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       0   0.0 [
    20.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  18   NAME: SPHALERITE
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00      0   0.0 [
    15.00      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00      2   5.8 [***
    15.00      8  23.5 [************
    20.00     13  38.2 [********************
    25.00      5  14.7 [********
    30.00      5  14.7 [********
    35.00      0   0.0 [
    40.00      0   0.0 [
    45.00      1   2.9 [**
    50.00      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00      6  46.1 [************************
    15.00      4  30.7 [****************
    20.00      2  15.3 [********
    25.00      1   7.6 [****
    30.00      0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00      1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)   NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00      0   0.0 [
    10.00     24  64.8 [*********************************
    15.00     12  32.4 [*****************
    20.00      0   0.0 [
    25.00      1   2.7 [**
    30.00      0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      67  45.5 [***********************
    15.00      43  29.2 [***************
    20.00      13   8.8 [*****
    25.00      11   7.4 [****
    30.00       5   3.4 [**
    35.00       2   1.3 [*
    40.00       3   2.0 [**
    45.00       2   1.3 [*
    50.00       1   0.6 [*
    55.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     377  54.9 [****************************
    15.00     183  26.6 [**************
    20.00      55   8.0 [*****
    25.00      32   4.6 [***
    30.00      16   2.3 [**
    35.00       8   1.1 [*
    40.00       5   0.7 [*
    45.00       6   0.8 [*
    50.00       1   0.1 [*
    55.00       2   0.2 [*
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       1   0.1 [*
    85.00       0   0.0 [
PRC: REPORT


SUMMARY OF RESULTS

LABEL: 85-153. PRINCE/HUB H.C.   1.8 SINK
NUMBER OF FRAMES               2
NUMBER OF PARTICLES         1011
MAGNIFICATION                 50
FIELD WIDTH=             1799.56 um
OFF PARTICLE SPACING=       4.83 um
ON PARTICLE SPACING=        0.43 um
FIELD AREA=             3.23E+06 um^2
TYPE          NAME                   AVE.DIA.                 MAX        MAX/MIN       AREA        PERIMETE
                                   · MICRONS                MICRONS                    uM^2        MICRONS
  0  ALL TYPES               1.58E+01  +-   1.45E+01    2.96E+01    4.61E+00    4.078E+02   8.424E+0
  1  PYRITE                  1.55E+01  +-   1.40E+01    2.62E+01    2.90E+00    3.619E+02   7.247E+01
  2  KAOLINITE               1.89E+01  +-   1.23E+01    3.26E+01    2.99E+00    4.519E+02   8.588E+0
  3  ILLITE                  1.81E+01  +-   2.17E+01    3.16E+01    3.67E+00    6.395E+02   9.208E+0
  4  QUARTZ                  1.64E+01  +-   2.46E+01    2.88E+01    2.67E+00    1.054E+03   7.894E+01
  5  SIDERITE                2.21E+01  +-   2.67E+01    4.05E+01    3.05E+00    1.166E+03   1.219E+0
  9  CHLORITE                1.49E+01  +-   0.00E+00    2.81E+01    2.90E+00    1.780E+02   8.437E+0
 10  SMECTITE                5.27E+00  +-   0.00E+00    6.59E+00    1.87E+00    2.597E+01   2.197E+0
 11  GYPSUM                  8.89E+00  +-   2.04E+00    1.43E+01    2.75E+00    7.657E+01   3.691E+01
 21  FeS (?)                 2.28E+01  +-   1.17E+01    4.01E+01    4.09E+00    5.675E+02   1.190E+0
 22  ILLITE + Ti             4.97E+01  +-   5.58E+01    7.99E+01    3.99E+00    4.264E+03   2.415E+0
 23  ZIRCON                  1.17E+01  +-   2.21E+00    2.87E+01    6.87E+00    1.344E+02   7.441E+01
 24  POLISH                  1.07E+01  +-   4.02E+00    2.24E+01    5.04E+00    1.162E+02   6.371E+01
 62  NON-INT                 1.50E+01  +-   1.50E+01    2.99E+01    5.53E+00    3.876E+02   8.748E+0
 63  UNKNOWN                 1.44E+01  +-   1.17E+01    2.88E+01    5.77E+00    3.114E+02   8.349E+01

PARTICLE COUNT SUMMARY
TYPE          NAME                 NUMBER      #(%)     T.AREA(%)
  0  ALL TYPES                      1011     100.00       6.36
  1  PYRITE                          150      14.83       0.83
  2  KAOLINITE                       140      13.84       0.97
  3  ILLITE                           52       5.14       0.51
  4  QUARTZ                           20       1.97       0.32
  5  SIDERITE                          6       0.59       0.10
  9  CHLORITE                          1       0.09       0.00
 10  SMECTITE                          1       0.09       0.00
 11  GYPSUM                            4       0.39       0.00
 21  FeS (?)                          29       2.86       0.25
 22  ILLITE + Ti                       5       0.49       0.32
 23  ZIRCON                            3       0.29       0.00
 24  POLISH                           49       4.84       0.08
 62  NON-INT                         228      22.55       1.36
 63  UNKNOWN                         323      31.94       1.55
```

```
FRC: HISTOGRAM


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00     416  41.1 [*********************
     15.00     237  23.4 [************
     20.00     155  15.3 [********
     25.00      74   7.3 [****
     30.00      39   3.8 [**
     35.00      20   1.9 [*
     40.00      18   1.7 [*
     45.00       9   0.8 [*
     50.00      11   1.0 [*
     55.00       3   0.2 [*
     60.00       4   0.3 [*
     65.00       3   0.2 [*
     70.00       7   0.6 [*
     75.00       2   0.1 [*
     80.00       3   0.2 [*
     85.00       1   0.0 [*
     90.00       3   0.2 [*
     95.00       1   0.0 [*
    100.00       1   0.0 [*
    105.00       0   0.0 [
    110.00       1   0.0 [*
    115.00       0   0.0 [
    120.00       1   0.0 [*
    125.00       0   0.0 [
    130.00       0   0.0 [
    135.00       0   0.0 [
    140.00       0   0.0 [
    145.00       0   0.0 [
    150.00       2   0.1 [*


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00      55  36.6 [*******************
     15.00      47  31.3 [****************
     20.00      21  14.0 [********
     25.00       8   5.3 [***
     30.00       5   3.3 [**
     35.00       3   2.0 [**
     40.00       2   1.3 [*
     45.00       1   0.6 [*
     50.00       6   4.0 [***
     55.00       0   0.0 [
     60.00       0   0.0 [
     65.00       0   0.0 [
     70.00       0   0.0 [
     75.00       0   0.0 [
     80.00       0   0.0 [
     85.00       0   0.0 [
     90.00       0   0.0 [
     95.00       0   0.0 [
    100.00       1   0.6 [*
    105.00       0   0.0 [
    110.00       1   0.6 [*
    115.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      26  18.5 [**********
    15.00      32  22.8 [************
    20.00      37  26.4 [**************
    25.00      19  13.5 [*******
    30.00      10   7.1 [****
    35.00       4   2.8 [**
    40.00       4   2.8 [**
    45.00       2   1.4 [*
    50.00       1   0.7 [*
    55.00       0   0.0 [
    60.00       1   0.7 [*
    65.00       2   1.4 [*
    70.00       1   0.7 [*
    75.00       1   0.7 [*
    80.00       0   0.0 [


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      22  42.3 [**********************
    15.00       9  17.3 [*********
    20.00       9  17.3 [*********
    25.00       5   9.6 [*****
    30.00       1   1.9 [*
    35.00       2   3.8 [**
    40.00       0   0.0 [
    45.00       0   0.0 [
    50.00       1   1.9 [*
    55.00       1   1.9 [*
    60.00       0   0.0 [
    65.00       1   1.9 [*
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       0   0.0 [
    85.00       0   0.0 [
    90.00       0   0.0 [
    95.00       0   0.0 [
   100.00       0   0.0 [
   105.00       0   0.0 [
   110.00       0   0.0 [
   115.00       0   0.0 [
   120.00       0   0.0 [
   125.00       0   0.0 [
   130.00       0   0.0 [
   135.00       0   0.0 [
   140.00       0   0.0 [
   145.00       0   0.0 [
   150.00       1   1.9 [*
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00      11  55.0 [****************************
     15.00       3  15.0 [********
     20.00       3  15.0 [********
     25.00       0   0.0 [
     30.00       2  10.0 [******
     35.00       0   0.0 [
     40.00       0   0.0 [
     45.00       0   0.0 [
     50.00       0   0.0 [
     55.00       0   0.0 [
     60.00       0   0.0 [
     65.00       0   0.0 [
     70.00       0   0.0 [
     75.00       0   0.0 [
     80.00       0   0.0 [
     85.00       0   0.0 [
     90.00       0   0.0 [
     95.00       0   0.0 [
    100.00       0   0.0 [
    105.00       0   0.0 [
    110.00       0   0.0 [
    115.00       0   0.0 [
    120.00       1   5.0 [***
    125.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00       3  50.0 [**************************
     15.00       0   0.0 [
     20.00       2  33.3 [*****************
     25.00       0   0.0 [
     30.00       0   0.0 [
     35.00       0   0.0 [
     40.00       0   0.0 [
     45.00       0   0.0 [
     50.00       0   0.0 [
     55.00       0   0.0 [
     60.00       0   0.0 [
     65.00       0   0.0 [
     70.00       0   0.0 [
     75.00       0   0.0 [
     80.00       1  16.6 [*********
     85.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   9   NAME: CHLORITE
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00       0   0.0 [
     15.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  10   NAME: SMECTITE
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00       1 100.0 [***************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       3  75.0 [**************************************
    15.00       1  25.0 [*************
    20.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       5  17.2 [*********
    15.00       3  10.3 [******
    20.00       5  17.2 [*********
    25.00       5  17.2 [*********
    30.00       3  10.3 [******
    35.00       4  13.7 [*******
    40.00       2   6.8 [****
    45.00       1   3.4 [**
    50.00       0   0.0 [
    55.00       1   3.4 [**
    60.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1  20.0 [***********
    15.00       0   0.0 [
    20.00       0   0.0 [
    25.00       0   0.0 [
    30.00       2  40.0 [*********************
    35.00       0   0.0 [
    40.00       1  20.0 [***********
    45.00       0   0.0 [
    50.00       0   0.0 [
    55.00       0   0.0 [
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       0   0.0 [
    85.00       0   0.0 [
    90.00       0   0.0 [
    95.00       0   0.0 [
   100.00       0   0.0 [
   105.00       0   0.0 [
   110.00       0   0.0 [
   115.00       0   0.0 [
   120.00       0   0.0 [
   125.00       0   0.0 [
   130.00       0   0.0 [
   135.00       0   0.0 [
   140.00       0   0.0 [
   145.00       0   0.0 [
   150.00       1  20.0 [***********
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1  33.3 [*****************
    15.00        2  66.6 [**********************************
    20.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       26  53.0 [***************************
    15.00       16  32.6 [*****************
    20.00        6  12.2 [*******
    25.00        1   2.0 [**
    30.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00      107  46.9 [************************
    15.00       59  25.8 [*************
    20.00       28  12.2 [*******
    25.00       13   5.7 [***
    30.00        3   1.3 [*
    35.00        2   0.8 [*
    40.00        3   1.3 [*
    45.00        1   0.4 [*
    50.00        1   0.4 [*
    55.00        1   0.4 [*
    60.00        0   0.0 [
    65.00        0   0.0 [
    70.00        5   2.1 [**
    75.00        0   0.0 [
    80.00        2   0.8 [*
    85.00        0   0.0 [
    90.00        3   1.3 [*
    95.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     155  47.9 [************************
    15.00      64  19.8 [***********
    20.00      44  13.6 [*******
    25.00      23   7.1 [****
    30.00      13   4.0 [***
    35.00       5   1.5 [*
    40.00       6   1.8 [*
    45.00       4   1.2 [*
    50.00       2   0.6 [*
    55.00       0   0.0 [
    60.00       3   0.9 [*
    65.00       0   0.0 [
    70.00       1   0.3 [*
    75.00       1   0.3 [*
    80.00       0   0.0 [
    85.00       1   0.3 [*
    90.00       0   0.0 [
    95.00       1   0.3 [*
   100.00       0   0.0 [
PRC: REP


SUMMARY OF RESULTS

LABEL: 85-197   MINTO/CHIPMAN     1.3f1
NUMBER OF FRAMES                1
NUMBER OF PARTICLES           395
MAGNIFICATION                  50
FIELD WIDTH=              1799.56 um
OFF PARTICLE SPACING=        4.83 um
ON PARTICLE SPACING=         0.43 um
FIELD AREA=              3.23E+06 um^2
TYPE         NAME                   AVE.DIA.                  MAX        MAX/MIN      AREA      PERIMETE
                                    MICRONS                 MICRONS                   uM^2      MICRONS
  0  ALL TYPES               8.73E+00 +-  3.74E+00       1.63E+01     3.60E+00   7.914E+01   4.523E+0
  1  PYRITE                  7.77E+00 +-  2.50E+00       1.34E+01     2.80E+00   5.903E+01   3.599E+0
  2  KAOLINITE               8.93E+00 +-  3.52E+00       1.48E+01     2.64E+00   7.593E+01   4.438E+0
  3  ILLITE                  8.65E+00 +-  3.84E+00       1.60E+01     3.84E+00   7.888E+01   4.325E+0
  4  QUARTZ                  8.31E+00 +-  2.78E+00       1.53E+01     2.98E+00   6.647E+01   3.876E+0
 14  RUTILE                  5.49E+00 +-  3.10E-01       1.09E+01     4.16E+00   2.945E+01   2.900E+0
 15  APATITE                 1.29E+01 +-  1.98E+00       2.50E+01     3.75E+00   1.428E+02   6.932E+0
 19  CHALCOPYRITE            1.27E+01 +-  0.00E+00       1.66E+01     1.89E+00   1.291E+02   6.723E+0
 20  ORGANIC SULPHUR         6.15E+00 +-  0.00E+00       1.36E+01     3.87E+00   3.833E+01   3.208E+0
 21  FeS (?)                 9.32E+00 +-  3.14E+00       1.60E+01     3.04E+00   8.536E+01   4.384E+0
 22  ILLITE + Ti             7.25E+00 +-  2.79E+00       1.05E+01     1.78E+00   4.663E+01   3.142E+0
 23  ZIRCON                  8.78E+00 +-  0.00E+00       1.80E+01     5.12E+00   9.057E+01   5.141E+0
 24  POLISH                  9.79E+00 +-  4.40E+00       1.95E+01     4.17E+00   1.003E+02   5.484E+0
 62  NON-INT                 9.45E+00 +-  5.16E+00       1.90E+01     4.58E+00   9.966E+01   5.539E+0
 63  UNKNOWN                 9.06E+00 +-  3.91E+00       1.73E+01     4.02E+00   8.590E+01   4.868E+0

PARTICLE COUNT SUMMARY
TYPE         NAME                  NUMBER     #(%)     T.AREA(%)
  0  ALL TYPES                       395    100.00        0.96
  1  PYRITE                          121     30.63        0.22
  2  KAOLINITE                         9      2.27        0.02
  3  ILLITE                           16      4.05        0.03
  4  QUARTZ                           24      6.07        0.04
 14  RUTILE                            2      0.50        0.00
 15  APATITE                           4      1.01        0.01
 19  CHALCOPYRITE                      1      0.25        0.00
 20  ORGANIC SULPHUR                   1      0.25        0.00
 21  FeS (?)                           9      2.27        0.02
 22  ILLITE + Ti                       2      0.50        0.00
 23  ZIRCON                            1      0.25        0.00
 24  POLISH                           31      7.84        0.09
 62  NON-INT                          56     14.17        0.17
 63  UNKNOWN                         118     29.87        0.31
```

```
PRC: HIS


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     297  75.1 [**************************************
    15.00      66  16.7 [*********
    20.00      26   6.5 [****
    25.00       3   0.7 [*
    30.00       3   0.7 [*
    35.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     102  84.2 [*******************************************
    15.00      16  13.2 [*******
    20.00       3   2.4 [**
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       6  66.6 [**********************************
    15.00       2  22.2 [************
    20.00       1  11.1 [******
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      12  75.0 [**************************************
    15.00       2  12.5 [*******
    20.00       2  12.5 [*******
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      20  83.3 [******************************************
    15.00       3  12.5 [*******
    20.00       1   4.1 [***
    25.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  14   NAME: RUTILE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       4 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  19   NAME: CHALCOPYRITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       7  77.7 [***************************************
    15.00       1  11.1 [******
    20.00       1  11.1 [******
    25.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00      18  58.0 [******************************
     15.00       9  29.0 [***************
     20.00       3   9.6 [*****
     25.00       1   3.2 [**
     30.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00      38  67.8 [**********************************
     15.00      10  17.8 [*********
     20.00       5   8.9 [*****
     25.00       1   1.7 [*
     30.00       2   3.5 [**
     35.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
      5.00       0   0.0 [
     10.00      88  74.5 [**************************************
     15.00      18  15.2 [********
     20.00      10   8.4 [*****
     25.00       1   0.8 [*
     30.00       1   0.8 [*
     35.00       0   0.0 [
PRC: REPORT


SUMMARY OF RESULTS

LABEL: 85-153  MINTO/CHIPMAN 2   1.5 SINK
NUMBER OF FRAMES             1
NUMBER OF PARTICLES        905
MAGNIFICATION               50
FIELD WIDTH=           1799.56 um
OFF PARTICLE SPACING=     4.83 um
ON PARTICLE SPACING=      0.43 um
FIELD AREA=           3.23E+06 um^2
TYPE          NAME                 AVE.DIA.               MAX        MAX/MIN     AREA       PERIMETE
                                   MICRONS              MICRONS.                 uM^2       MICRONS
  0  ALL TYPES               1.21E+01 +-  7.78E+00   2.22E+01   3.57E+00  1.810E+02  6.042E+0
  1  PYRITE                  1.14E+01 +-  6.28E+00   2.01E+01   2.83E+00  1.495E+02  5.344E+0
  2  KAOLINITE               1.06E+01 +-  8.40E+00   2.01E+01   3.23E+00  1.635E+02  5.096E+0
  3  ILLITE                  1.57E+01 +-  1.50E+01   3.21E+01   3.67E+00  4.137E+02  8.266E+0
  4  QUARTZ                  1.35E+01 +-  6.09E+00   2.17E+01   2.81E+00  1.849E+02  5.935E+0
  5  SIDERITE                2.24E+01 +-  6.83E+00   3.99E+01   3.32E+00  4.437E+02  1.085E+0
  9  CHLORITE                5.71E+00 +-  0.00E+00   9.66E+00   2.00E+00  2.964E+01  2.900E+0
 15  APATITE                 8.49E+00 +-  1.66E+00   1.31E+01   2.46E+00  6.804E+01  3.457E+0
 16  MONAZITE                4.61E+01 +-  0.00E+00   1.13E+02   8.35E+00  1.719E+03  3.331E+0
 21  FeS (?)                 2.01E+01 +-  9.52E+00   3.50E+01   2.90E+00  4.255E+02  9.545E+0
 22  ILLITE + Ti             1.01E+01 +-  4.19E+00   2.15E+01   5.49E+00  1.005E+02  5.698E+0
 24  POLISH                  1.20E+01 +-  8.22E+00   2.17E+01   3.65E+00  1.715E+02  6.723E+0
 62  NON-INT                 1.36E+01 +-  9.02E+00   2.62E+01   5.28E+00  2.282E+02  7.568E+0
 63  UNKNOWN                 1.13E+01 +-  7.05E+00   2.18E+01   4.39E+00  1.578E+02  6.097E+0

PARTICLE COUNT SUMMARY
TYPE          NAME                  NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                        905     100.00        5.05
  1  PYRITE                           334      42.43        1.77
  2  KAOLINITE                         52       5.74        0.26
  3  ILLITE                            35       3.86        0.44
  4  QUARTZ                            28       3.09        0.15
  5  SIDERITE                           2       0.22        0.02
  9  CHLORITE                           1       0.11        0.00
 15  APATITE                            3       0.33        0.00
 16  MONAZITE                           1       0.11        0.05
 21  FeS (?)                           33       3.64        0.43
 22  ILLITE + Ti                        3       0.33        0.00
 24  POLISH                            10       1.10        0.05
 62  NON-INT                           51       5.63        0.35
 63  UNKNOWN                          302      33.37        1.47
```

```
PRC: HISTOGRAM


AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   0   NAME: ALL TYPES
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
    5.00        0   0.0 [
   10.00      465  51.3 [**************************
   15.00      246  27.1 [**************
   20.00       94  10.3 [******
   25.00       38   4.1 [***
   30.00       25   2.7 [**
   35.00       16   1.7 [*
   40.00        7   0.7 [*
   45.00        6   0.6 [*
   50.00        4   0.4 [*
   55.00        2   0.2 [*
   60.00        1   0.1 [*
   65.00        0   0.0 [
   70.00        0   0.0 [
   75.00        1   0.1 [*
   80.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   1   NAME: PYRITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
    5.00        0   0.0 [
   10.00      197  51.3 [**************************
   15.00      117  30.4 [****************
   20.00       42  10.9 [******
   25.00       14   3.6 [**
   30.00        6   1.5 [*
   35.00        1   0.2 [*
   40.00        5   1.3 [*
   45.00        0   0.0 [
   50.00        2   0.5 [*
   55.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
    5.00        0   0.0 [
   10.00       37  71.1 [************************************
   15.00        7  13.4 [*******
   20.00        4   7.6 [****
   25.00        1   1.9 [*
   30.00        1   1.9 [*
   35.00        0   0.0 [
   40.00        0   0.0 [
   45.00        1   1.9 [*
   50.00        1   1.9 [*
   55.00        0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00       17  48.5 [*************************
    15.00        8  22.8 [************
    20.00        3   8.5 [*****
    25.00        1   2.8 [**
    30.00        2   5.7 [***
    35.00        1   2.8 [**
    40.00        0   0.0 [
    45.00        1   2.8 [**
    50.00        0   0.0 [
    55.00        0   0.0 [
    60.00        1   2.8 [**
    65.00        0   0.0 [
    70.00        0   0.0 [
    75.00        1   2.8 [**
    80.00        0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        7  25.0 [*************
    15.00       12  42.8 [**********************
    20.00        5  17.8 [*********
    25.00        2   7.1 [****
    30.00        1   3.5 [**
    35.00        1   3.5 [**
    40.00        0   0.0 [
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        0   0.0 [
    15.00        0   0.0 [
    20.00        1  50.0 [*************************
    25.00        0   0.0 [
    30.00        1  50.0 [*************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   9   NAME: CHLORITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        3 100.0 [**************************************************
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  16   NAME: MONAZITE
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        0   0.0 [
    15.00        0   0.0 [
    20.00        0   0.0 [
    25.00        0   0.0 [
    30.00        0   0.0 [
    35.00        0   0.0 [
    40.00        0   0.0 [
    45.00        0   0.0 [
    50.00        1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        3   9.0 [*****
    15.00       11  33.3 [*****************
    20.00        3   9.0 [*****
    25.00        4  12.1 [*******
    30.00        6  18.1 [**********
    35.00        4  12.1 [*******
    40.00        1   3.0 [**
    45.00        1   3.0 [**
    50.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        1  33.3 [*****************
    15.00        2  66.6 [**********************************
    20.00        0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)     NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00        0   0.0 [
    10.00        7  70.0 [************************************
    15.00        1  10.0 [******
    20.00        1  10.0 [******
    25.00        0   0.0 [
    30.00        0   0.0 [
    35.00        1  10.0 [******
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      22  43.1 [**********************
    15.00      14  27.4 [**************
    20.00       4   7.8 [****
    25.00       6  11.7 [******
    30.00       0   0.0 [
    35.00       3   5.8 [***
    40.00       1   1.9 [*
    45.00       1   1.9 [*
    50.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00     170  56.2 [*****************************
    15.00      74  24.5 [*************
    20.00      31  10.2 [******
    25.00      10   3.3 [**
    30.00       8   2.6 [**
    35.00       5   1.6 [*
    40.00       0   0.0 [
    45.00       2   0.6 [*
    50.00       0   0.0 [
    55.00       2   0.6 [*
    60.00       0   0.0 [
FRC: REPORT


SUMMARY OF RESULTS

LABEL: 85-153 MINTO/CHIPMAN 2   1.8 SINK
NUMBER OF FRAMES              1
NUMBER OF PARTICLES        1221
MAGNIFICATION                50
FIELD WIDTH=          1799.56 um
OFF PARTICLE SPACING=    4.83 um
ON PARTICLE SPACING=     0.43 um
FIELD AREA=           3.23E+06 um^2
TYPE         NAME                    AVE.DIA.               MAX          MAX/MIN     AREA        PERIMETER
                                     MICRONS                MICRONS                  uM^2        MICRONS
  0  ALL TYPES                1.32E+01 +-  9.18E+00      2.31E+01      3.38E+00   2.255E+02   6.443E+01
  1  PYRITE                   1.18E+01 +-  7.00E+00      2.03E+01      3.09E+00   1.635E+02   5.549E+01
  2  KAOLINITE                1.21E+01 +-  1.31E+01      2.13E+01      3.66E+00   2.631E+02   5.943E+01
  3  ILLITE                   1.46E+01 +-  1.42E+01      2.76E+01      4.25E+00   3.682E+02   7.585E+01
  4  QUARTZ                   1.50E+01 +-  1.05E+01      2.43E+01      3.12E+00   2.881E+02   6.909E+01
  5  SIDERITE                 1.78E+01 +-  1.04E+01      3.11E+01      2.97E+00   3.479E+02   9.711E+01
  6  CALCITE                  1.31E+01 +-  0.00E+00      2.02E+01      2.42E+00   1.416E+02   5.097E+01
 11  GYPSUM                   1.14E+01 +-  0.00E+00      2.72E+01      4.76E+00   1.234E+02   6.459E+01
 15  APATITE                  7.69E+00 +-  1.55E+00      1.01E+01      1.63E+00   5.402E+01   3.098E+01
 20  ORGANIC SULPHUR          5.71E+00 +-  0.00E+00      7.91E+00      1.63E+00   3.070E+01   2.416E+01
 21  FeS (?)                  1.87E+01 +-  9.47E+00      3.24E+01      3.36E+00   3.665E+02   9.259E+01
 22  ILLITE + Ti              1.17E+01 +-  6.06E+00      2.43E+01      6.48E+00   1.896E+02   6.833E+01
 23  ZIRCON                   6.59E+00 +-  0.00E+00      1.45E+01      4.12E+00   4.422E+01   4.042E+01
 24  POLISH                   1.09E+01 +-  3.83E+00      2.09E+01      3.38E+00   1.134E+02   5.654E+01
 62  NON-INT                  1.39E+01 +-  1.01E+01      2.57E+01      4.33E+00   2.663E+02   7.732E+01
 63  UNKNOWN                  1.47E+01 +-  1.14E+01      2.69E+01      3.86E+00   3.135E+02   7.652E+01

PARTICLE COUNT SUMMARY
TYPE         NAME                    NUMBER     #(%)    T.AREA(%)
  0  ALL TYPES                        1221     100.00       8.50
  1  PYRITE                            710      58.14       3.58
  2  KAOLINITE                          31       2.53       0.25
  3  ILLITE                             54       4.42       0.61
  4  QUARTZ                             63       5.15       0.56
  5  SIDERITE                            8       0.65       0.08
  6  CALCITE                             1       0.08       0.00
 11  GYPSUM                              1       0.08       0.00
 15  APATITE                             2       0.16       0.00
 20  ORGANIC SULPHUR                     1       0.08       0.00
 21  FeS (?)                            83       6.79       0.93
 22  ILLITE + Ti                         8       0.65       0.04
 23  ZIRCON                              1       0.08       0.00
 24  POLISH                              3       0.24       0.01
 62  NON-INT                            52       4.25       0.42
 63  UNKNOWN                           203      16.62       1.96
```

```
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   2   NAME: KAOLINITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      19  61.2 [*******************************
    15.00       8  25.8 [*************
    20.00       3   9.6 [*****
    25.00       0   0.0 [
    30.00       0   0.0 [
    35.00       0   0.0 [
    40.00       0   0.0 [
    45.00       0   0.0 [
    50.00       0   0.0 [
    55.00       0   0.0 [
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       0   0.0 [
    85.00       1   3.2 [**
    90.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   3   NAME: ILLITE
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      26  48.1 [*************************
    15.00      14  25.9 [*************
    20.00       4   7.4 [****
    25.00       5   9.2 [*****
    30.00       0   0.0 [
    35.00       3   5.5 [***
    40.00       0   0.0 [
    45.00       0   0.0 [
    50.00       0   0.0 [
    55.00       0   0.0 [
    60.00       0   0.0 [
    65.00       1   1.8 [*
    70.00       0   0.0 [
    75.00       0   0.0 [
    80.00       0   0.0 [
    85.00       0   0.0 [
    90.00       0   0.0 [
    95.00       1   1.8 [*
   100.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   4   NAME: QUARTZ
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      28  44.4 [***********************
    15.00      14  22.2 [************
    20.00       6   9.5 [*****
    25.00       5   7.9 [****
    30.00       2   3.1 [**
    35.00       3   4.7 [***
    40.00       3   4.7 [***
    45.00       1   1.5 [*
    50.00       0   0.0 [
    55.00       1   1.5 [*
    60.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   5   NAME: SIDERITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1  12.5 [*******
    15.00       3  37.5 [*******************
    20.00       1  12.5 [*******
    25.00       2  25.0 [*************
    30.00       0   0.0 [
    35.00       0   0.0 [
    40.00       1  12.5 [*******
    45.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:   6   NAME: CALCITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  11   NAME: GYPSUM
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       0   0.0 [
    15.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  15   NAME: APATITE
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  20   NAME: ORGANIC SULPHUR
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [***************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  21   NAME: FeS (?)
BIN MAX(uM)    NO.  %    00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      10  12.0 [*******
    15.00      27  32.5 [*****************
    20.00      15  18.0 [**********
    25.00      14  16.8 [*********
    30.00       5   6.0 [****
    35.00       6   7.2 [****
    40.00       2   2.4 [**
    45.00       3   3.6 [**
    50.00       1   1.2 [*
    55.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  22   NAME: ILLITE + Ti
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       4  50.0 [*************************
    15.00       1  12.5 [*******
    20.00       2  25.0 [*************
    25.00       1  12.5 [*******
    30.00       0   0.0 [

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  23   NAME: ZIRCON
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       1 100.0 [**************************************************

AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  24   NAME: POLISH
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00       2  66.6 [*********************************
    15.00       0   0.0 [
    20.00       1  33.3 [*****************
    25.00       0   0.0 [

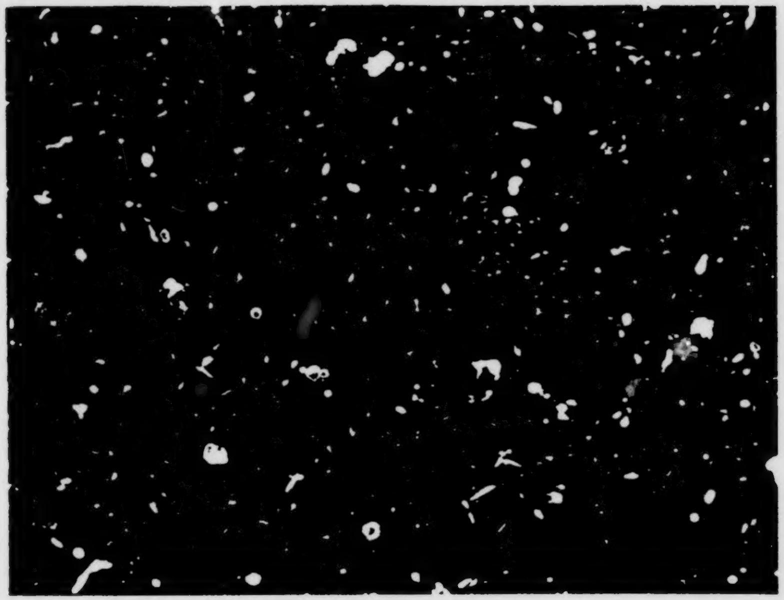
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  62   NAME: NON-INT
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      26  50.0 [*************************
    15.00      12  23.0 [************
    20.00       3   5.7 [***
    25.00       2   3.8 [**
    30.00       2   3.8 [**
    35.00       4   7.6 [****
    40.00       2   3.8 [**
    45.00       0   0.0 [
    50.00       1   1.9 [*
    55.00       0   0.0 [
AVERAGE DIAMETER HISTOGRAM FOR  TYPE:  63   NAME: UNKNOWN
BIN MAX(uM)    NO.  %   00---10---20---30---40---50---60---70---80---90---100
     5.00       0   0.0 [
    10.00      83  40.8 [*********************
    15.00      55  27.0 [**************
    20.00      22  10.8 [******
    25.00      21  10.3 [******
    30.00       8   3.9 [**
    35.00       3   1.4 [*
    40.00       1   0.4 [*
    45.00       6   2.9 [**
    50.00       1   0.4 [*
    55.00       1   0.4 [*
    60.00       0   0.0 [
    65.00       0   0.0 [
    70.00       0   0.0 [
    75.00       1   0.4 [*
    80.00       0   0.0 [
    85.00       0   0.0 [
    90.00       0   0.0 [
    95.00       0   0.0 [
   100.00       1   0.4 [*
   105.00       0   0.0 [
```

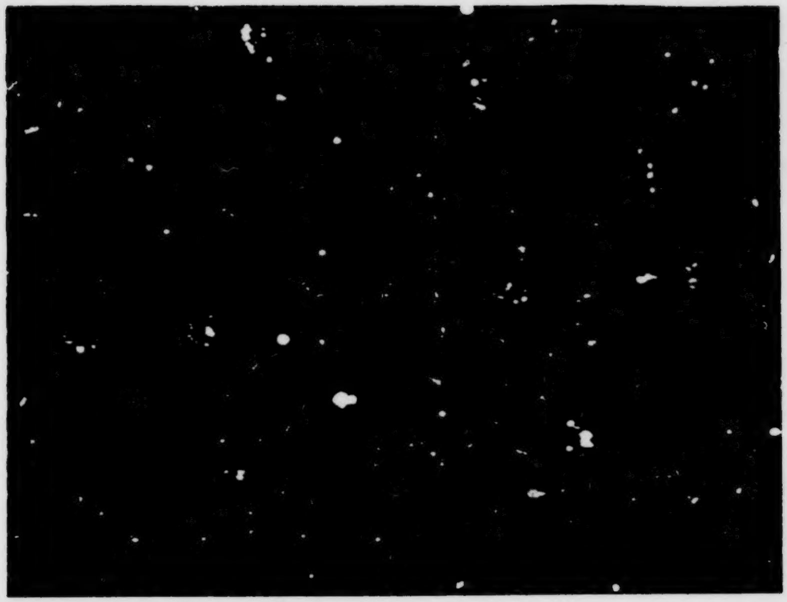
PLATE 11

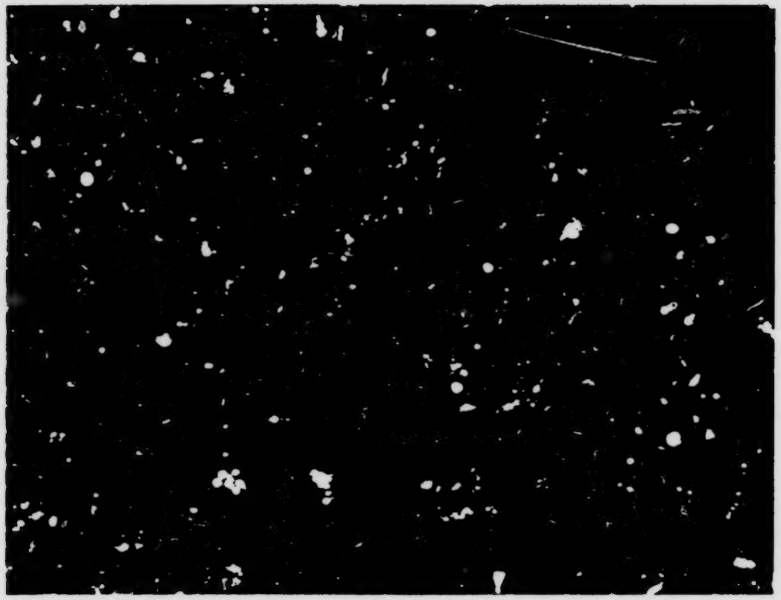
MINERAL ANALYSIS
Prince/Hub -42 mesh to +100 mesh sieve fraction; 1.30 float
Low Temperature Ashed; float-sunk:
2.00 float, 2.85 float, 2.85 sink

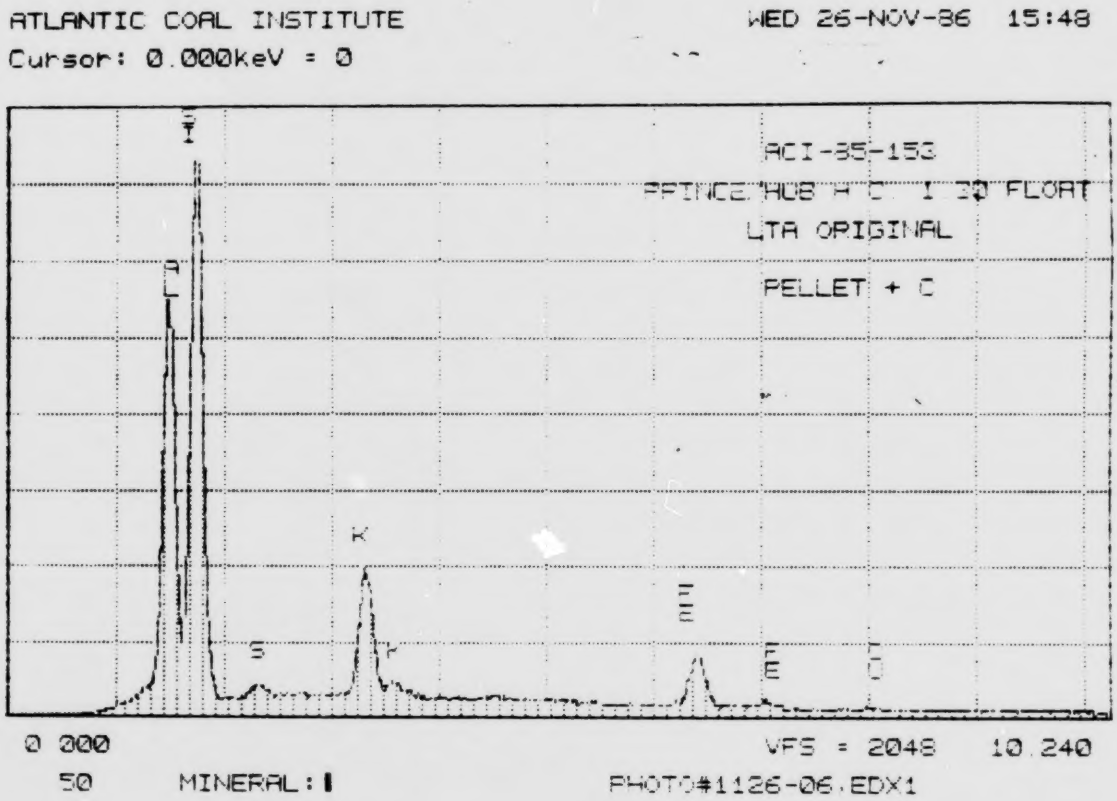
Photo No.	Index No.	Description	Spectra No.
1	1126-06	Original LTA; 100x; SEI	
2	1126-07	Same as P#1, 100x; BEI	1,2,3,4
3	1126-08	2.85 float; 100x; BEI	5,6,7,8,9,10

Note: No sample for 2.00 float and 2.85 sink


1

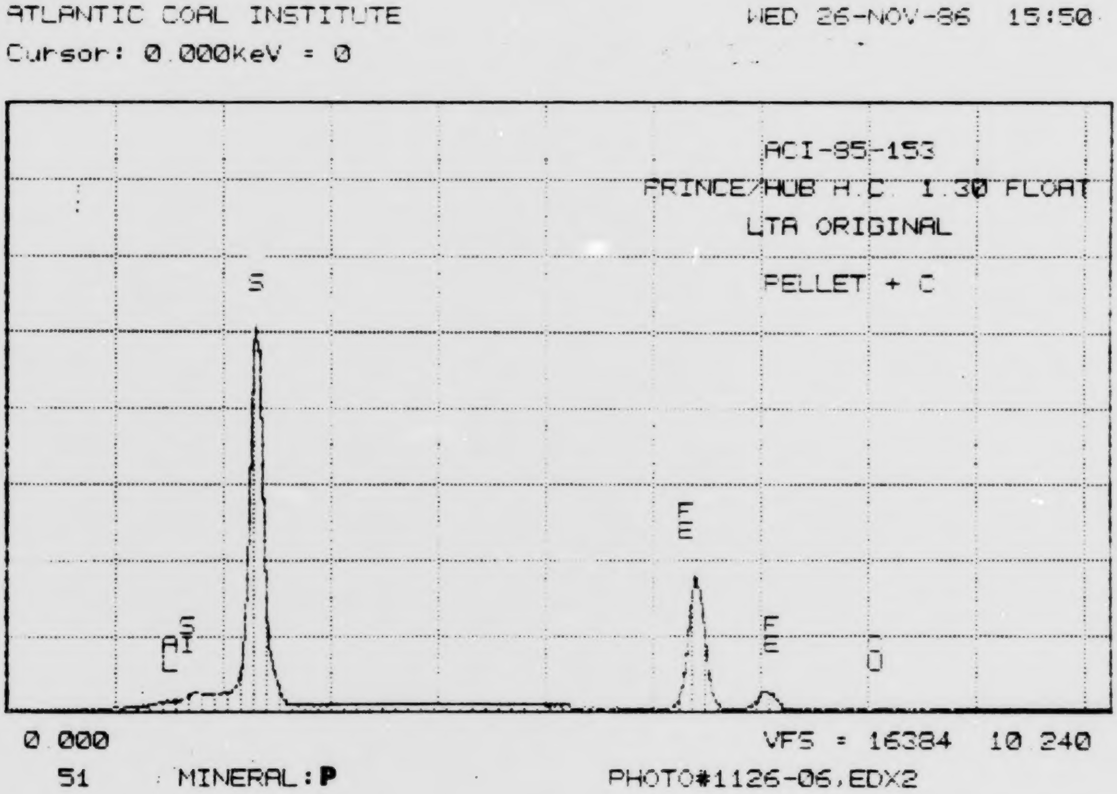

2


3


ATLANTIC COAL INSTITUTE WED 26-NOV-86 15:48
Cursor: 0.000keV = 0

0.000 VFS = 2048 10.240
50 MINERAL: I PHOTO#1126-06.EDX1

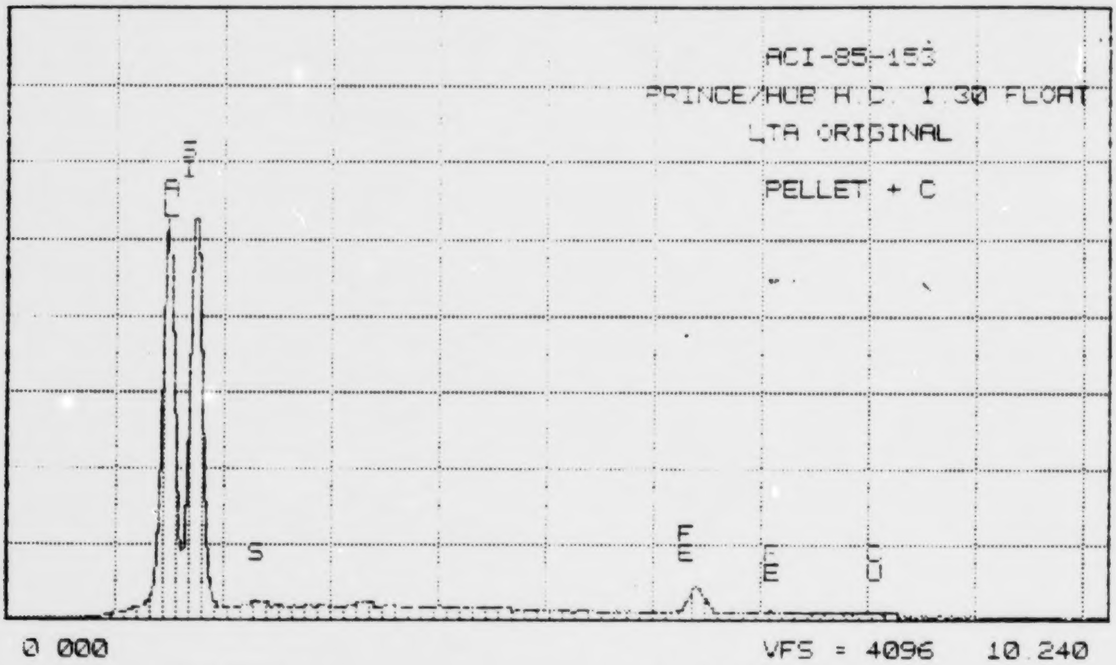
1


ATLANTIC COAL INSTITUTE WED 26-NOV-86 15:50
Cursor: 0.000keV = 0

0.000 VFS = 16384 10.240
51 MINERAL: P PHOTO#1126-06.EDX2

2

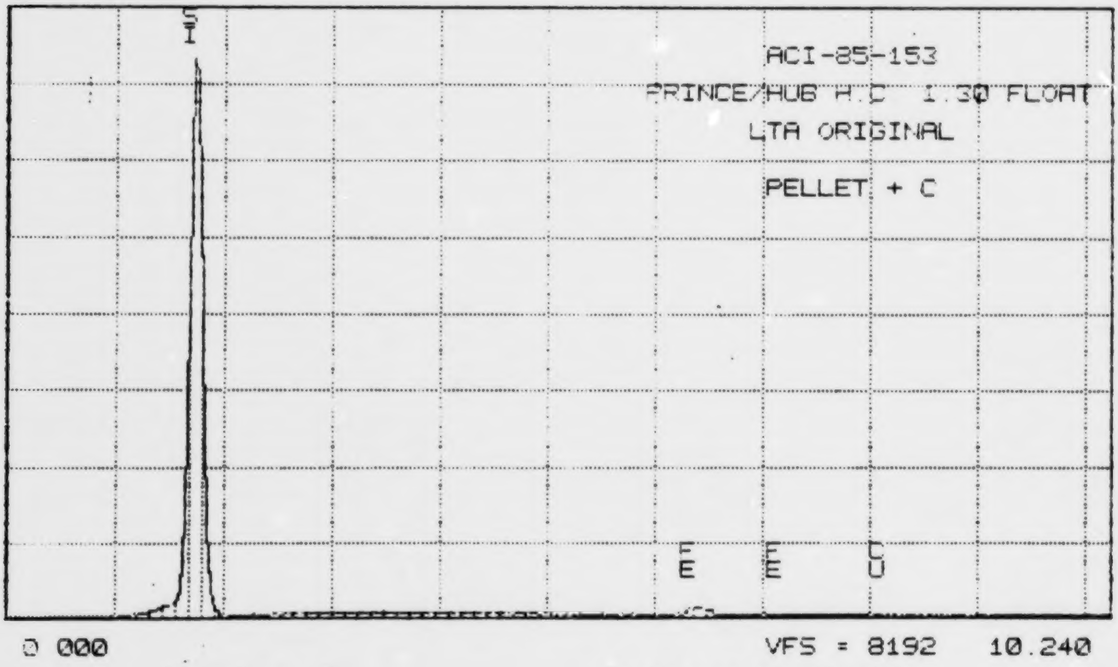
ATLANTIC COAL INSTITUTE WED 26-NOV-86 15:52
Cursor: 0.000keV = 0



3

50 MINERAL:**K** PHOTO#1126-06.EDX3

ATLANTIC COAL INSTITUTE WED 26-NOV-86 15:54
Cursor: 0.000keV = 0

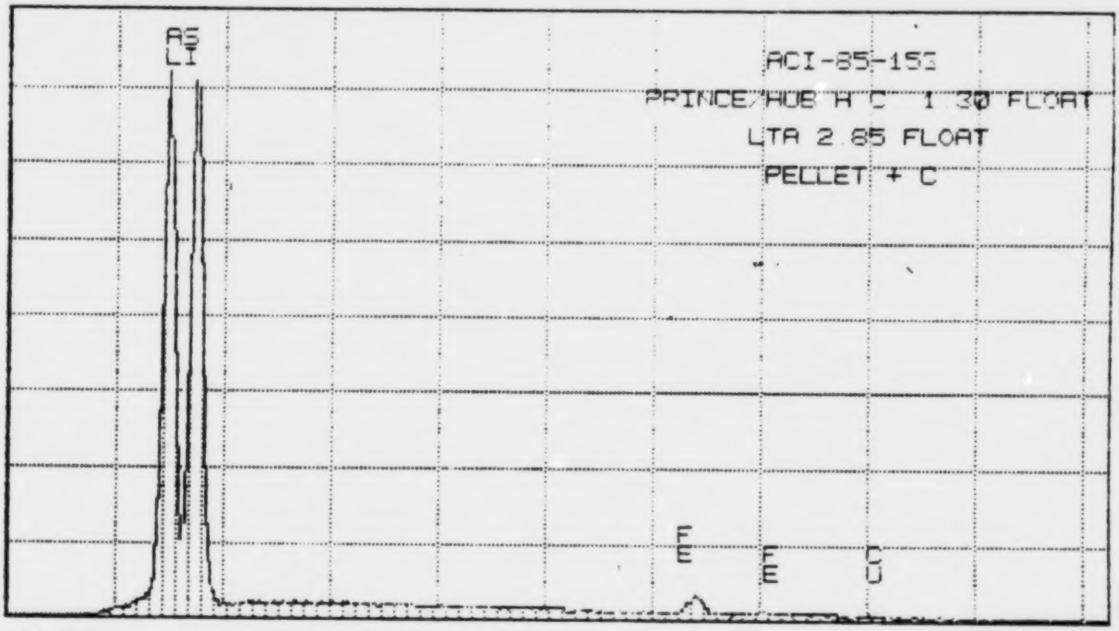


4

50 MINERAL:**Q** PHOTO#1126-06.EDX4

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:00

Cursor: 0.000keV = 0



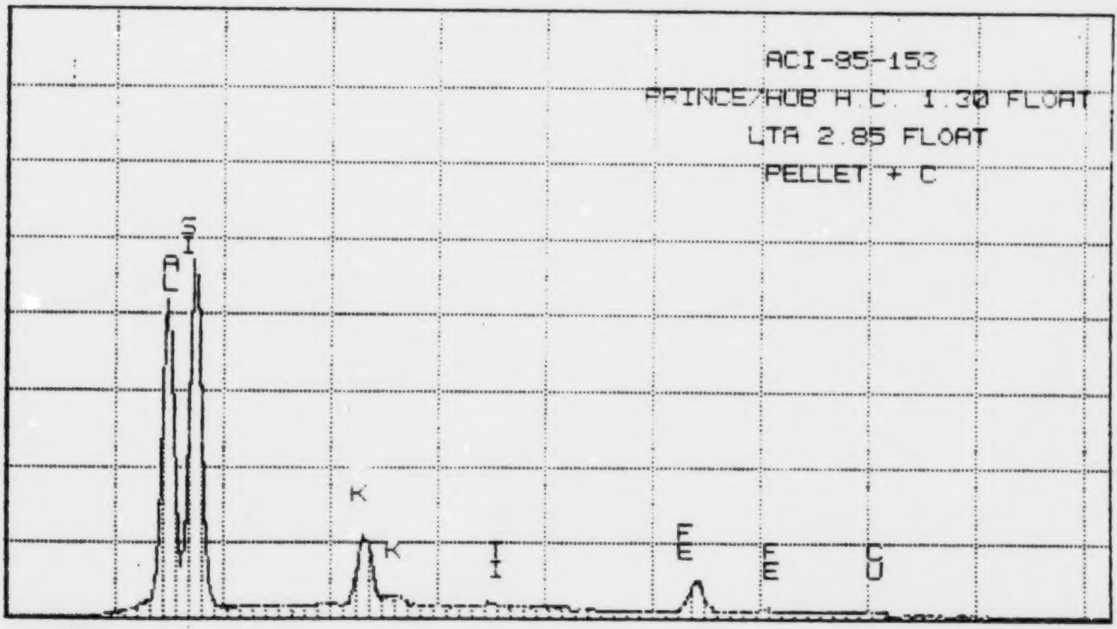
5

0.000 VFS = 4096 10.240

50 MINERAL: **K** PHOTO#1126-08,EDX1

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:02

Cursor: 0.000keV = 0

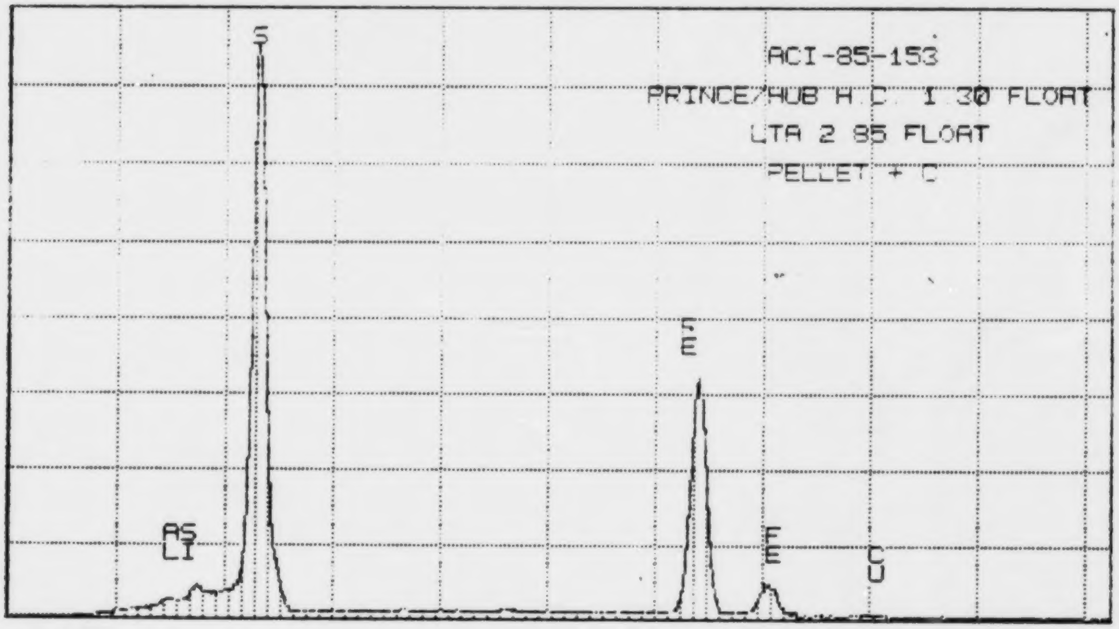


6

0.000 VFS = 4096 10.240

50 MINERAL: **I + TI** PHOTO#1126-08,EDX2

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:04
Cursor: 0.000keV = 0 [illegible] 0.000

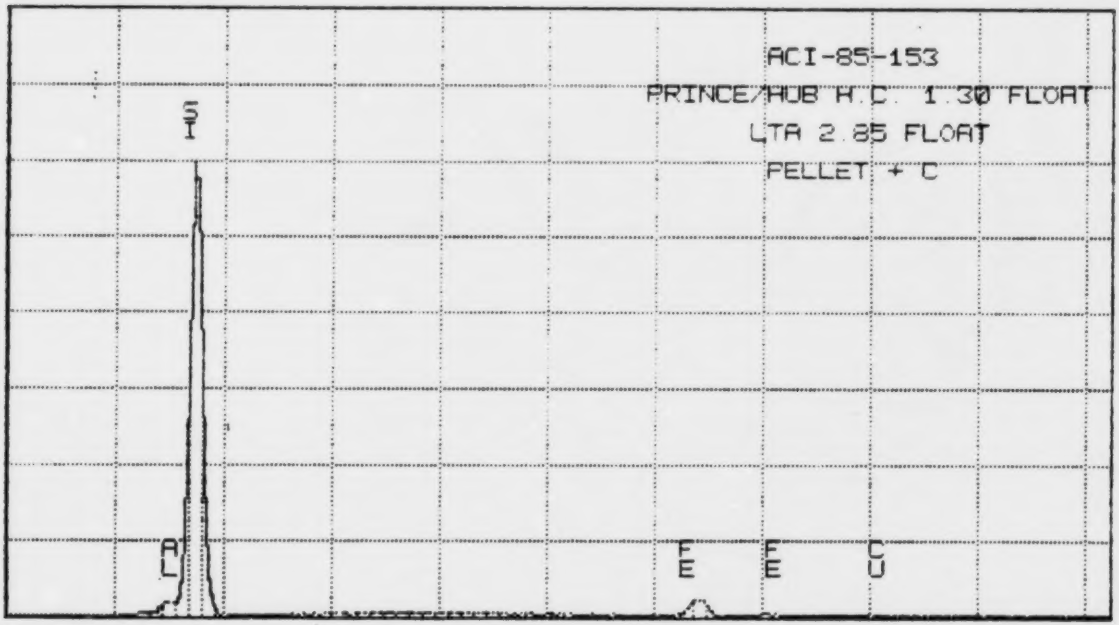


ACI-85-153
PRINCE/HUB H.C. 1.30 FLOAT
LTA 2.85 FLOAT
PELLET + C

7

0.000 VFS = 8192 10.240
50 MINERAL:P PHOTO#1126-08,EDX3

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:06
Cursor: 0.000keV = 0



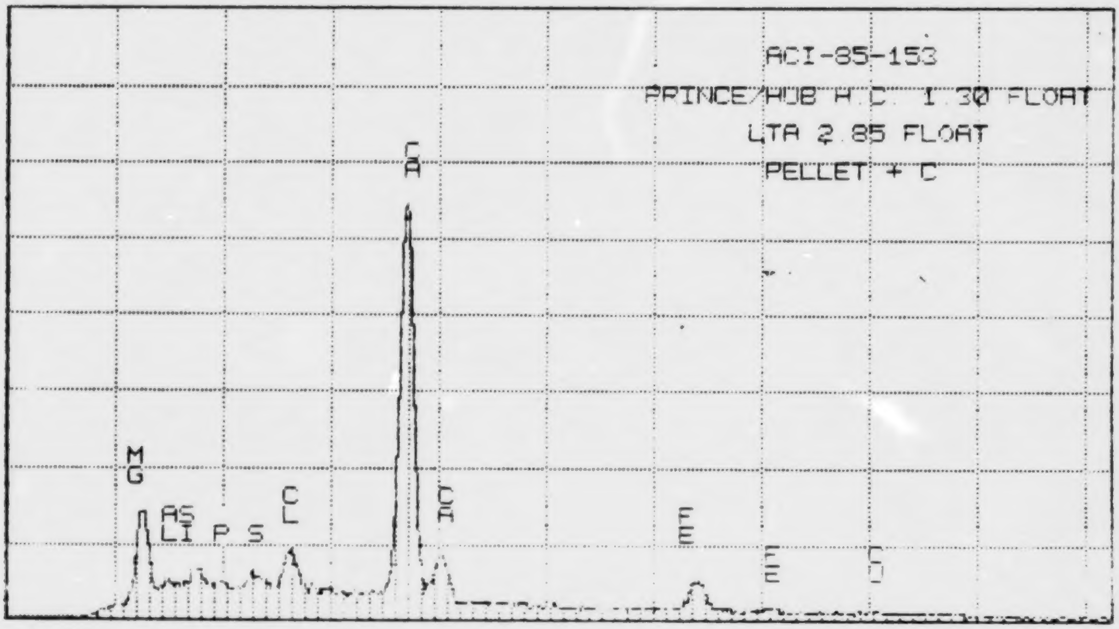
ACI-85-153
PRINCE/HUB H.C. 1.30 FLOAT
LTA 2.85 FLOAT
PELLET + C

8

0.000 VFS = 8192 10.240
50 MINERAL:Q PHOTO#1126-08,EDX4

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:08

Cursor: 0.000keV = 0


ACI-85-153
PRINCE/HUB H.C. 1.30 FLOAT
LTA 2.85 FLOAT
PELLET + C

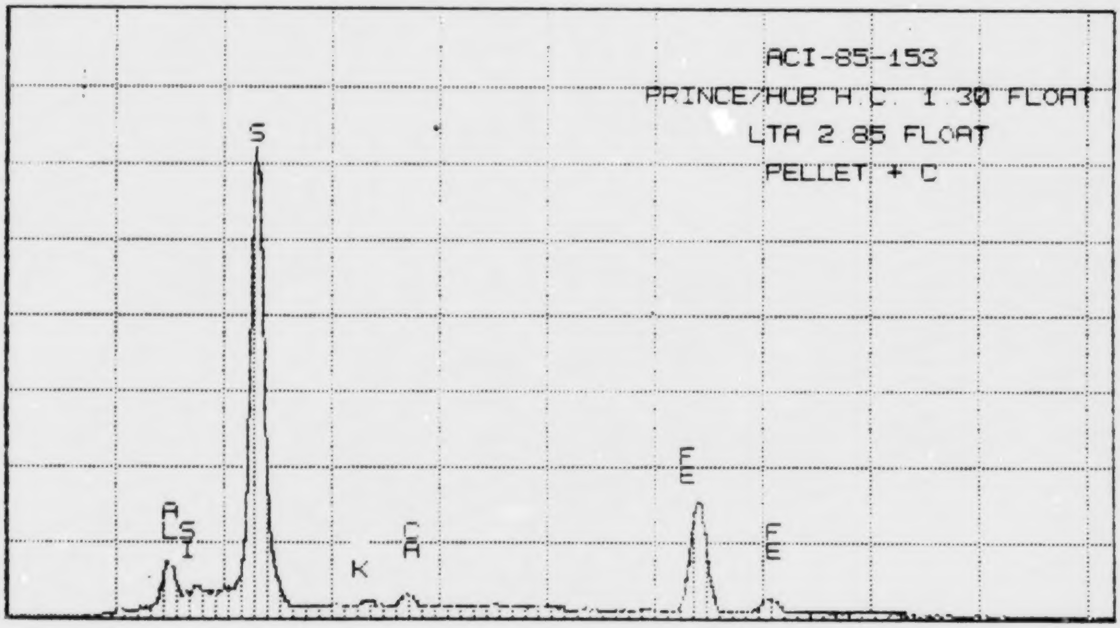
9

0.000 VFS = 2048 10.240

50 MINERAL: **C** PHOTO#1126-08.EDX5

ATLANTIC COAL INSTITUTE WED 26-NOV-86 16:10

Cursor: 0.000keV = 0


ACI-85-153
PRINCE/HUB H.C. 1.30 FLOAT
LTA 2.85 FLOAT
PELLET + C

10

0.000 VFS = 4096 10.240

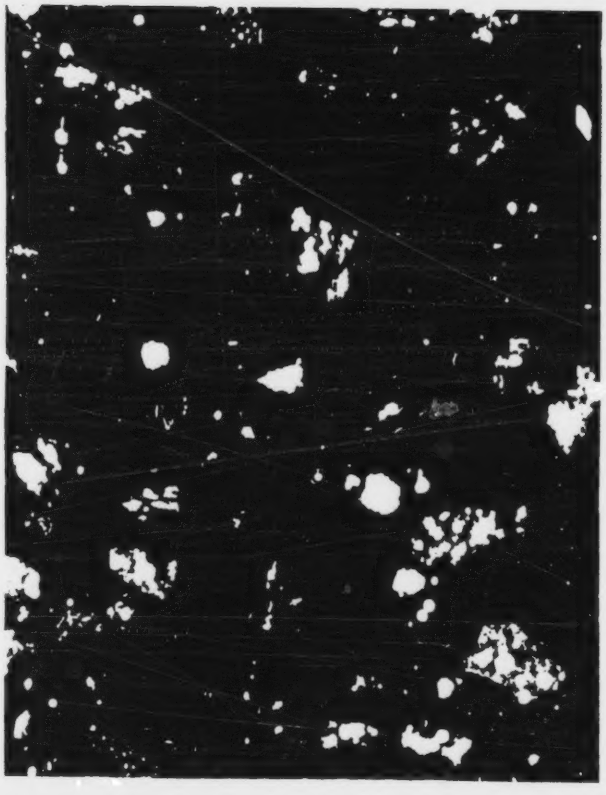
50 MINERAL: **P** PHOTO#1126-08.EDX6

PLATE 12

MINERAL ANALYSIS
Prince/Hub -42 mesh to +100 mesh sieve fraction; 1.50 sink
Low Temperature Ashed; float-sunk:
2.00 float, 2.85 float, 2.85 sink

Photo No.	Index No.	Description	Spectra No.
1	1114-03	Original LTA; 100x; BEI	1,2,3,4,5,6
2	1114-04	2.85 float; 100x; BEI	7,8,9,10,11,12,13
3	1114-05	2.85 sink; 100x; BEI	14,15,16,17,18,19 20,21,22

Note: No sample for 2.00 float

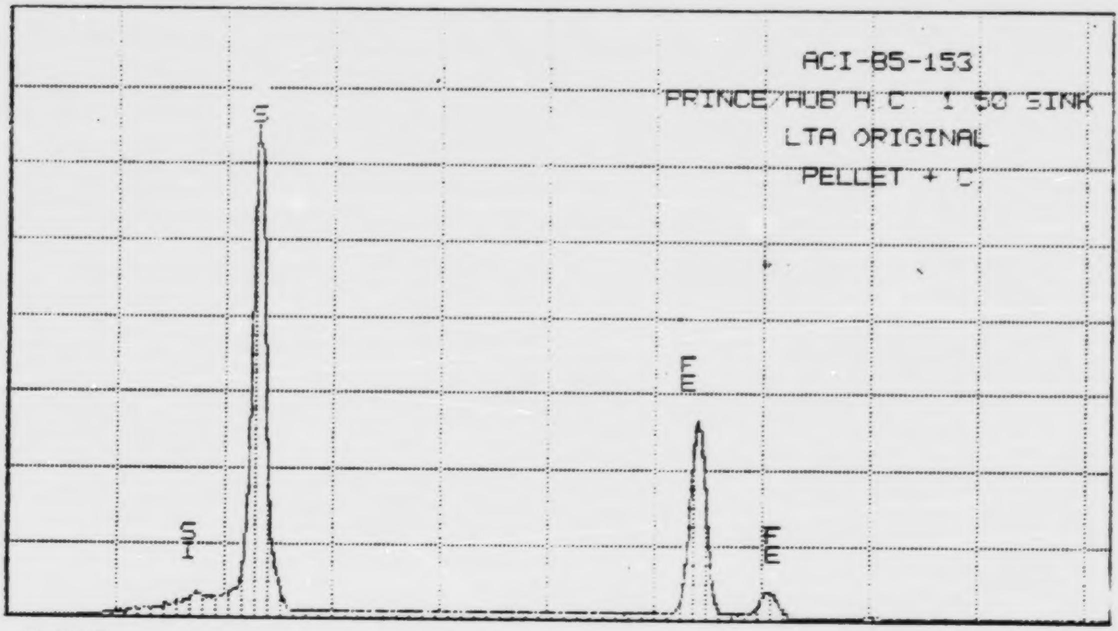


1

2

3

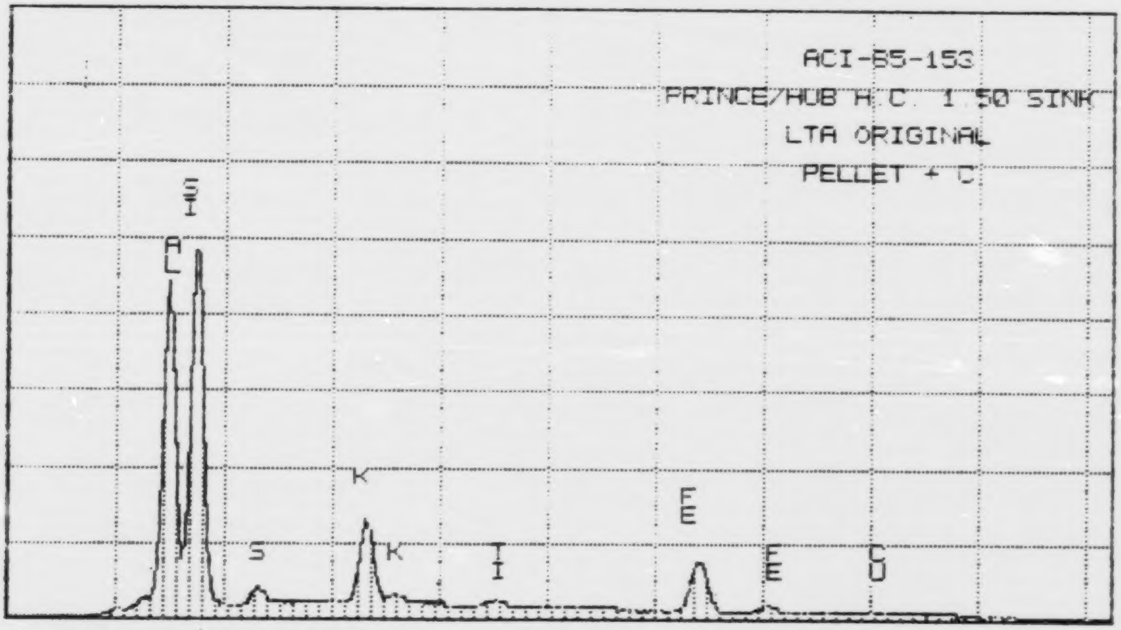
ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:37
Cursor: 0.000keV = 0



1

0.000 VFS = 4096 10.240
50 MINERAL: **P** PHOTO#1114-03.EDX1

ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:39
Cursor: 0.000keV = 0

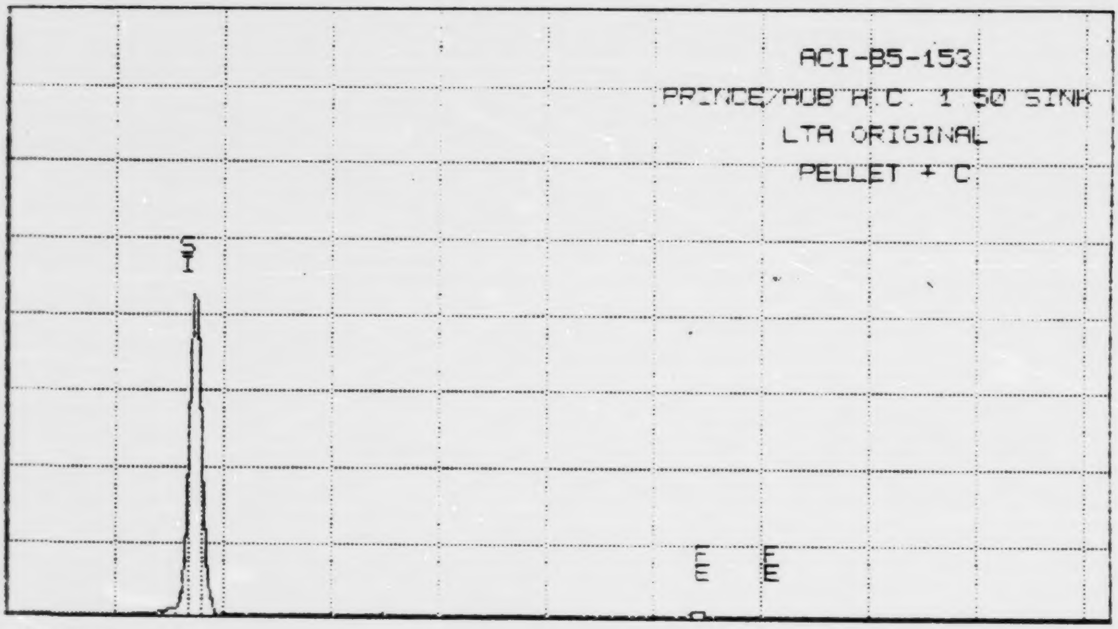


2

0.000 VFS = 8192 10.240
50 MINERAL: **I+TI** PHOTO#1114-03.EDX2

ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:41

Cursor: 0.000keV = 0



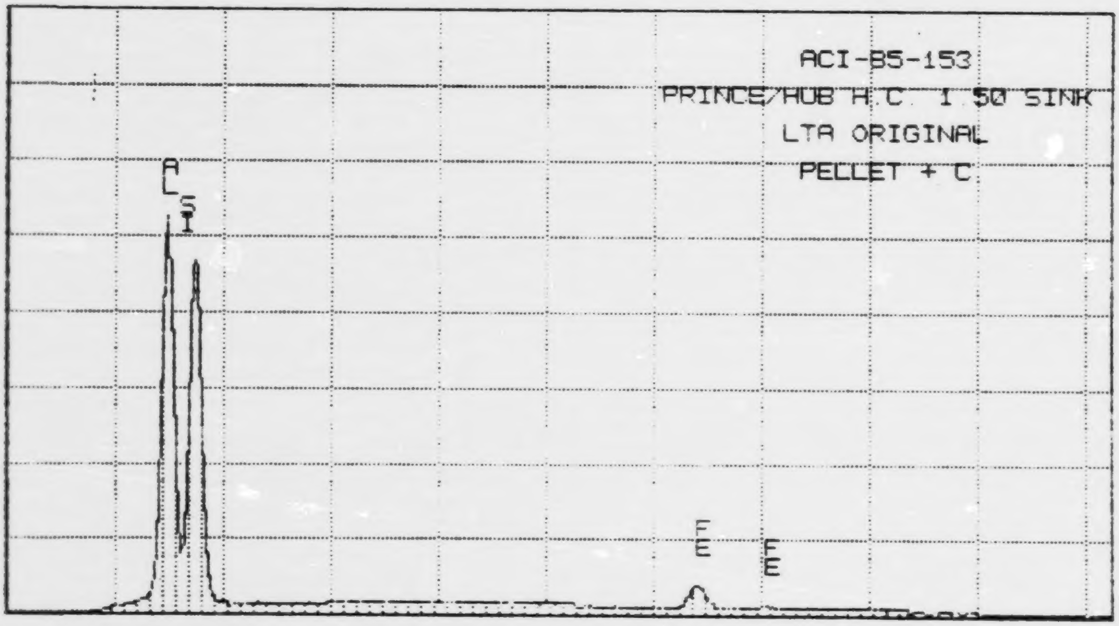
3

0.000 VFS = 32768 10.240

50 MINERAL;**Q** PHOTO#1114-03.EDX3

ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:43

Cursor: 0.000keV = 0

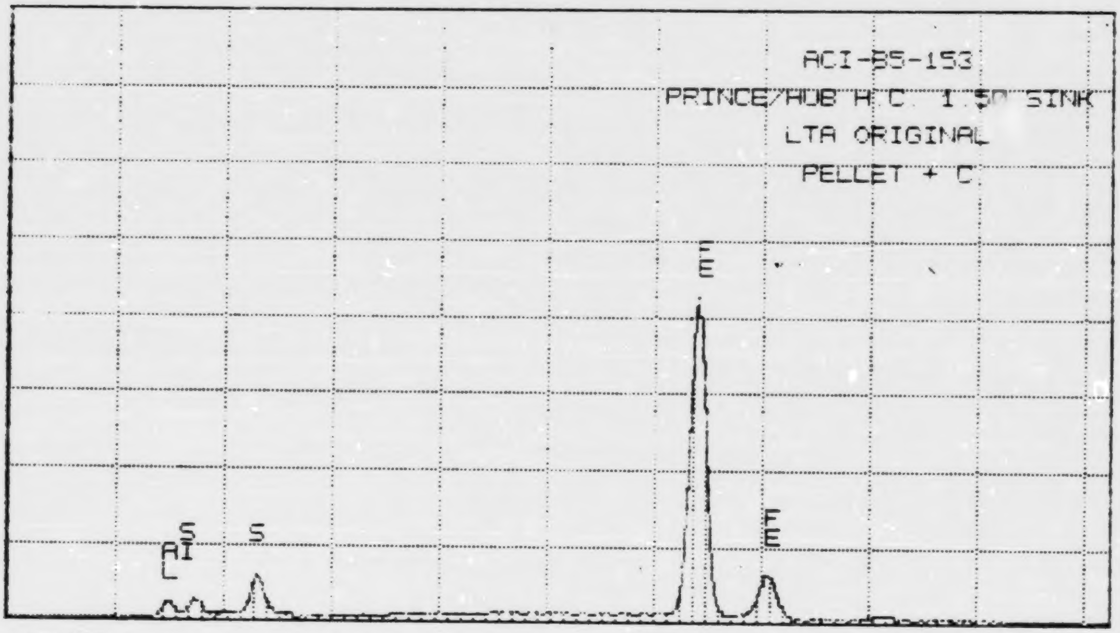


4

0.000 VFS = 8192 10.240

50 MINERAL:**K** PHOTO#1114-03.EDX4

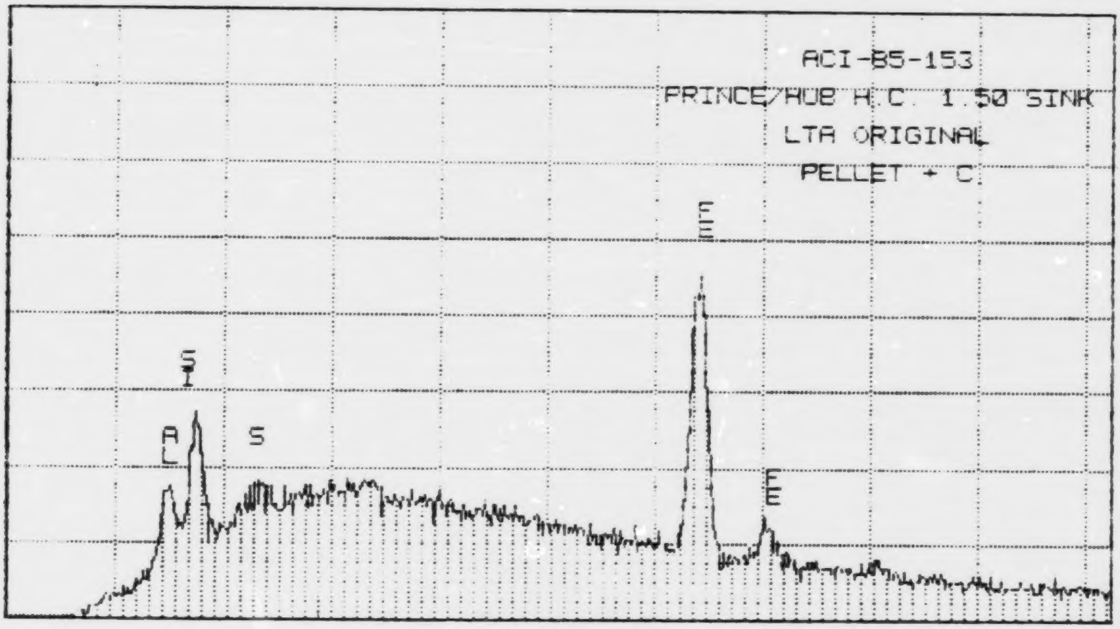
ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:46
Cursor: 0.000keV = 0



5

0 000 VFS = 8192 10.240
50 MINERAL: ? PHOTO#1114-03,EDX5

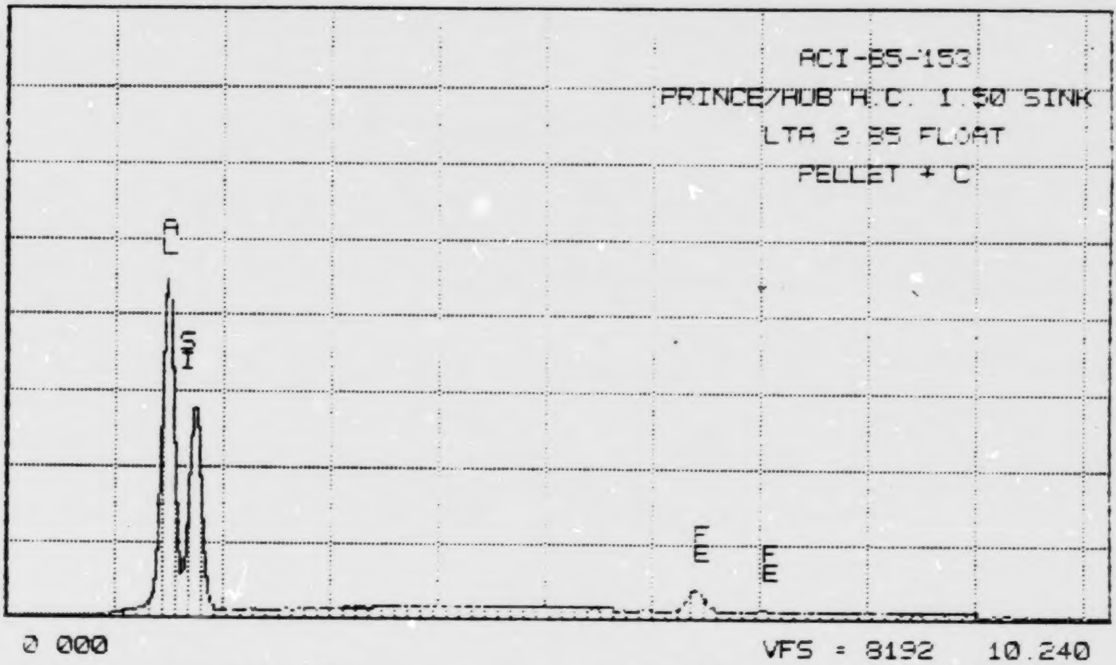
ATLANTIC COAL INSTITUTE FRI 14-NOV-86 16:48
Cursor: 0.000keV = 0



6

0 000 VFS = 512 10 240
50 MATRIX: PHOTO#1114-03,EDX6

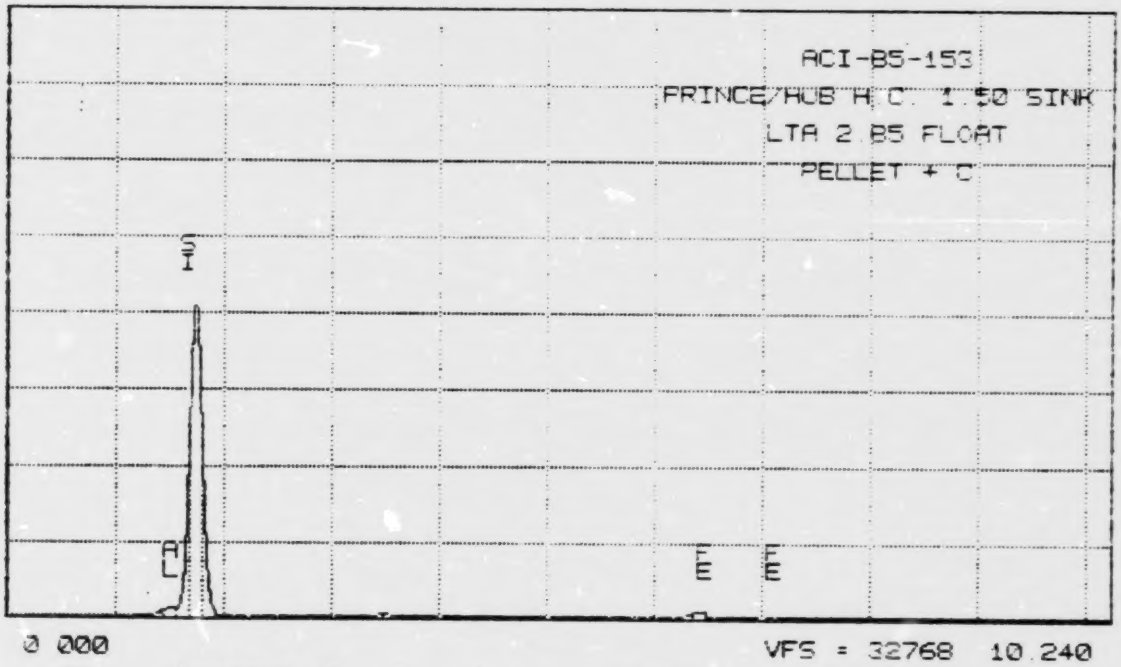
ATLANTIC COAL INSTITUTE MON 17-NOV-86 08:31
Cursor: 0.000keV = 0



7

50 MINERAL: **K** PHOTO#1114-04,EDX1

ATLANTIC COAL INSTITUTE MON 17-NOV-86 08:33
Cursor: 0.000keV = 0

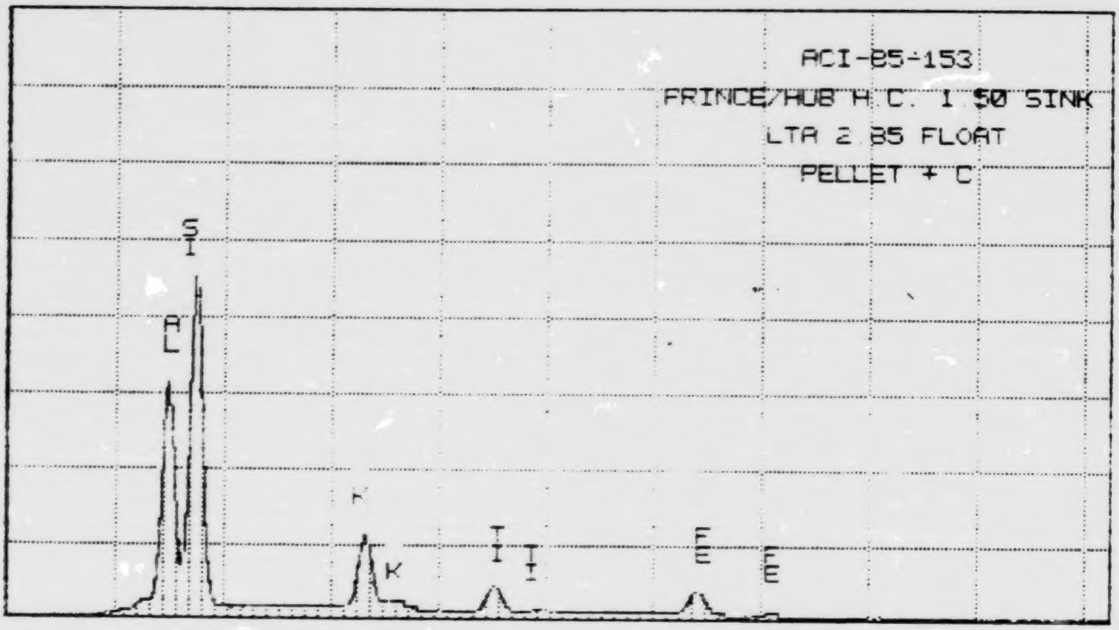


8

50 MINERAL: **Q** PHOTO#1114-04,EDX2

ATLANTIC COAL INSTITUTE MON 17-NOV-86 08:35

Cursor: 0.000keV = 0



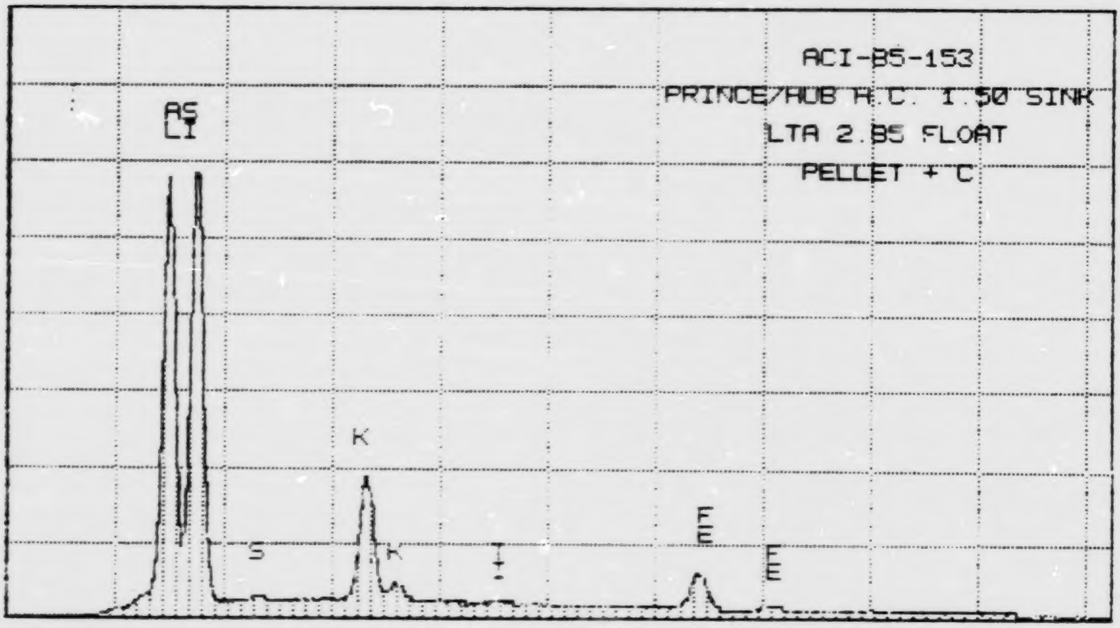
9

0.000 VFS = 16384 10.240

50 MINERAL: I+TI PHOTO#1114-04.EDX3

ATLANTIC COAL INSTITUTE MON 17-NOV-86 08:37

Cursor: 0.000keV = 0



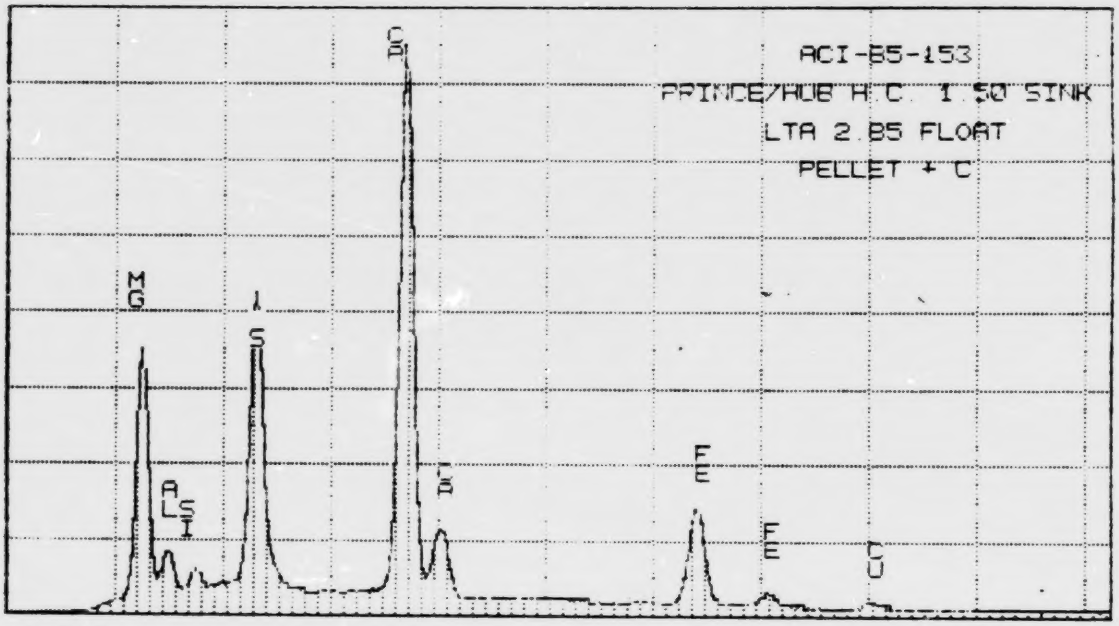
10

0.000 VFS = 8192 10.240

50 MINERAL: I+TI PHOTO#1114-04.EDX4

ATLANTIC COAL INSTITUTE MON 17-NOV-86 09:12

Cursor: 0.000keV = 0



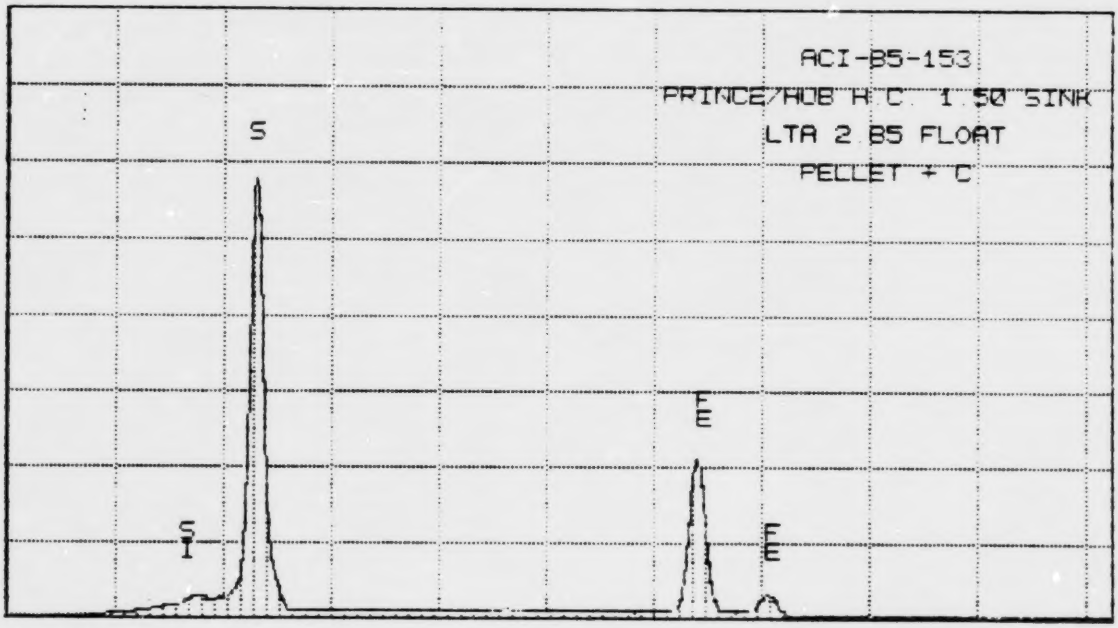
11

0.000 VFS = 8192 10.240

50 MINERAL: **Dol + P** PHOTO#1114-04,EDX5

ATLANTIC COAL INSTITUTE MON 17-NOV-86 09:15

Cursor: 0.000keV = 0



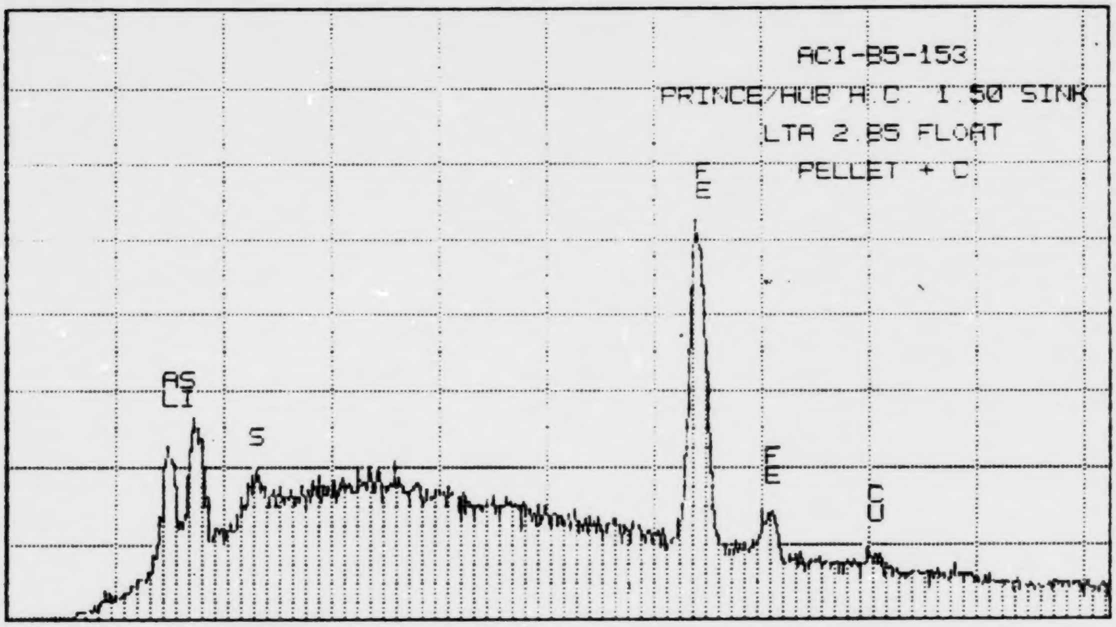
12

0.000 VFS = 32768 10.240

50 MINERAL: **P** PHOTO#1114-04,EDX6

ATLANTIC COAL INSTITUTE MON 17-NOV-86 09:18

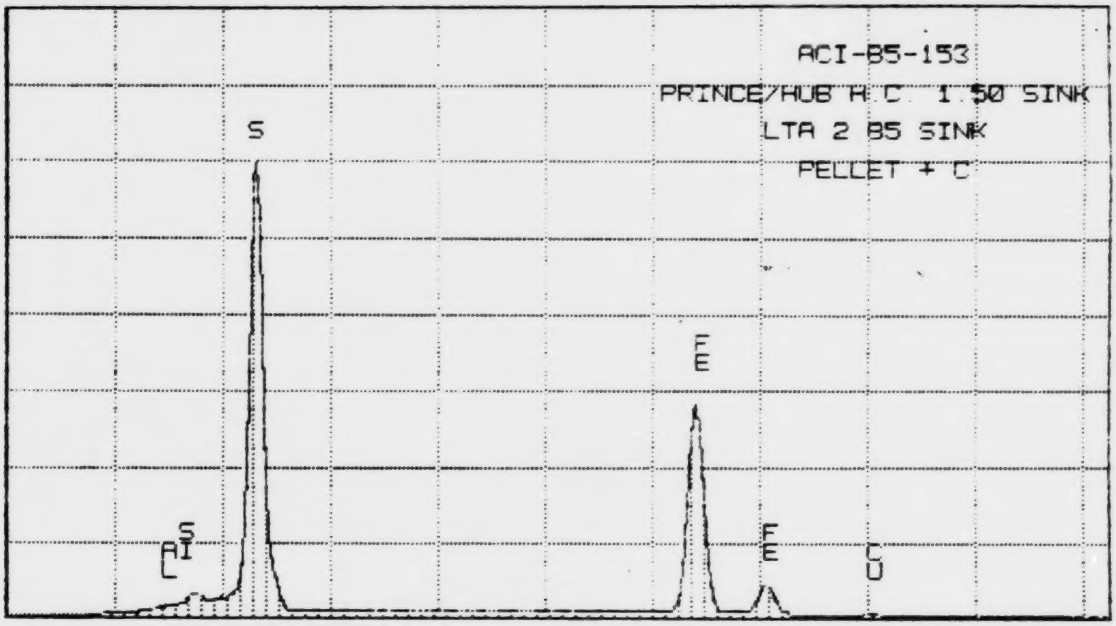
Cursor: 0.000keV = 0



0.000 VFS = 512 10.240

50 MATRIX: PHOTO#1114-04,EDX7

ATLANTIC COAL INSTITUTE MON 17-NOV-86 09:21
Cursor: 0.000keV = 0

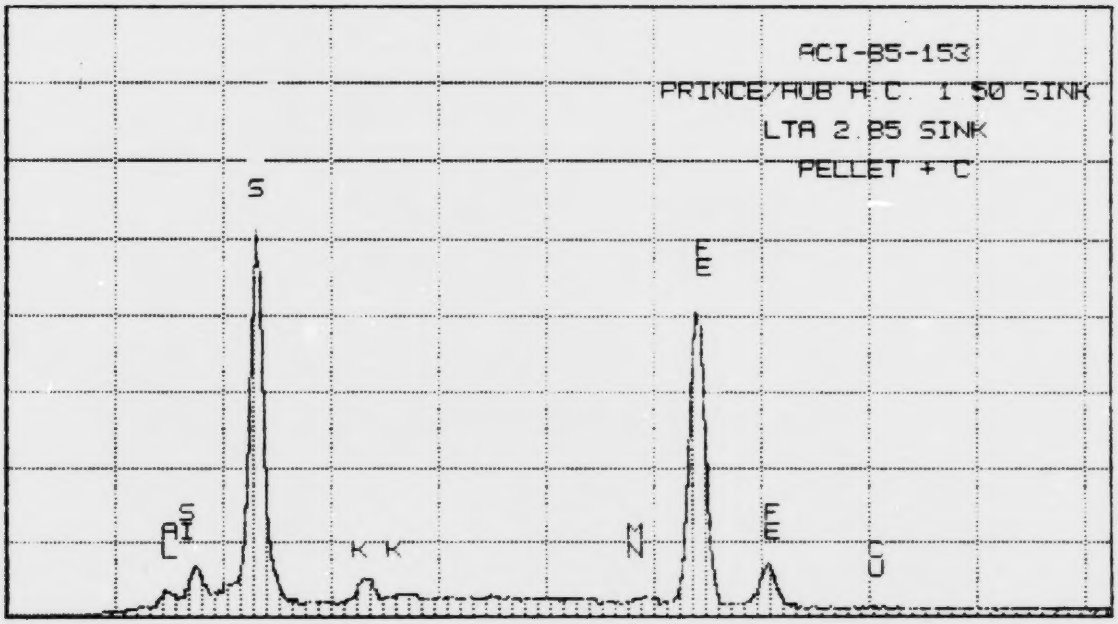


ACI-85-153
PRINCE/HUB A.C. 1.50 SINK
LTA 2.85 SINK
PELLET + C

0.000 VFS = 16384 10.240
50 MINERAL:P PHOTO#1114-05,EDX1

14

ATLANTIC COAL INSTITUTE MON 17-NOV-86 09:25
Cursor: 0.000keV = 0

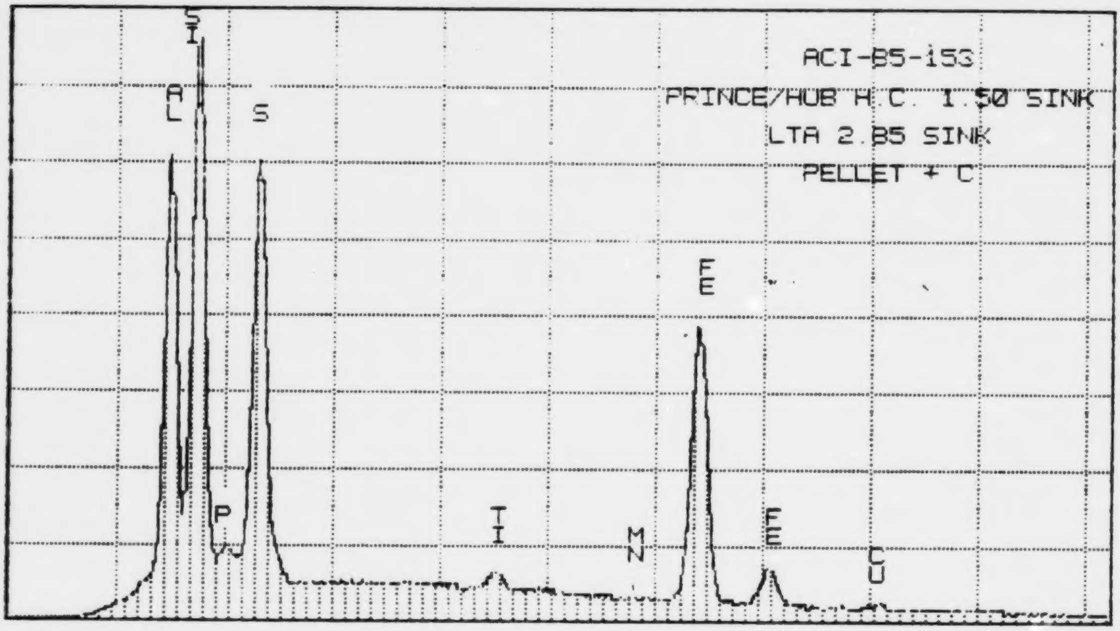


ACI-85-153
PRINCE/HUB A.C. 1.50 SINK
LTA 2.85 SINK
PELLET + C

0.000 VFS = 4096 10.240
50 MINERAL:P PHOTO#1114-05,EDX2

15

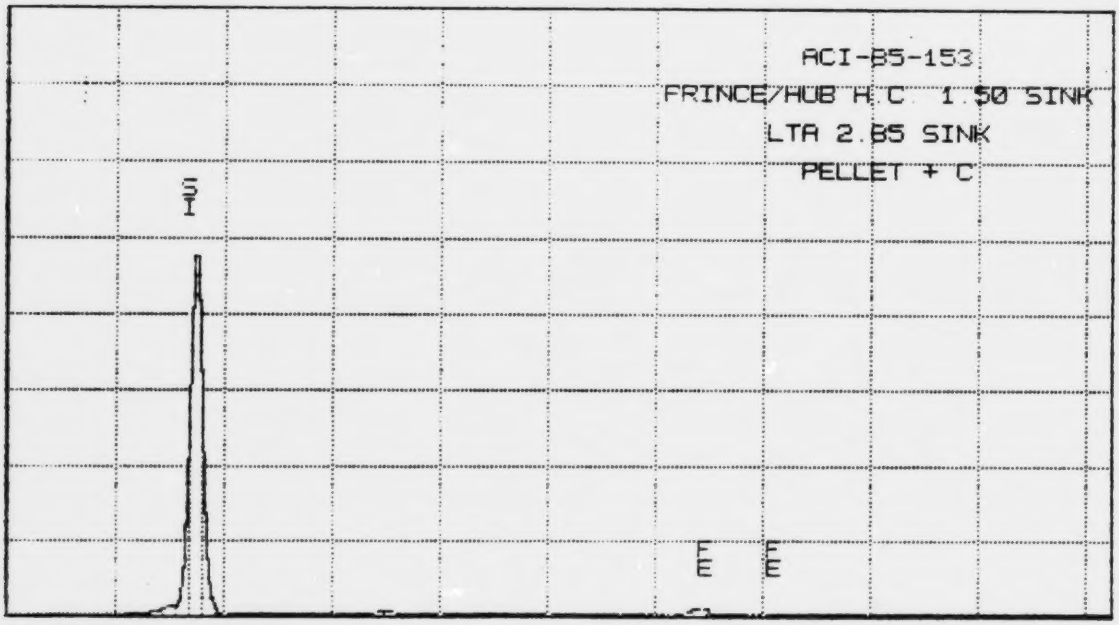
ATLANTIC COAL INSTITUTE MON 17-NOV-86 10:24
Cursor: 0.000keV = 0



16

0.000 VFS = 4096 10.240
50 MINERAL: PHOTO#1114-05,EDX3

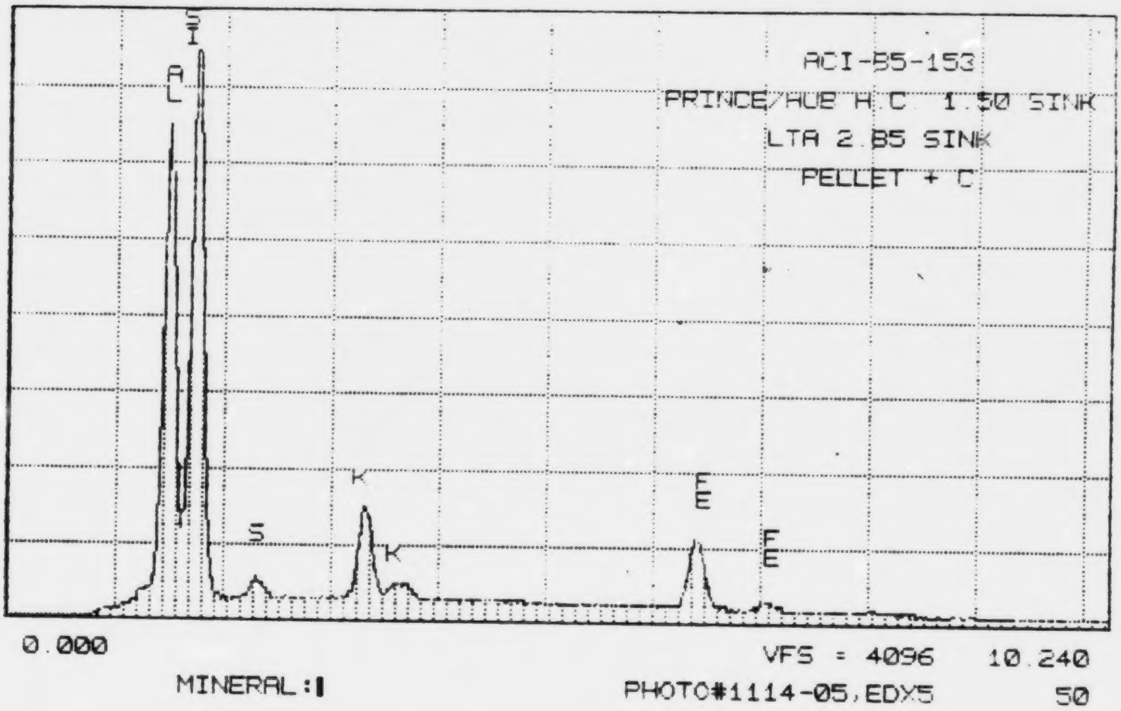
ATLANTIC COAL INSTITUTE MON 17-NOV-86 10:30
Cursor: 0.000keV = 0



17

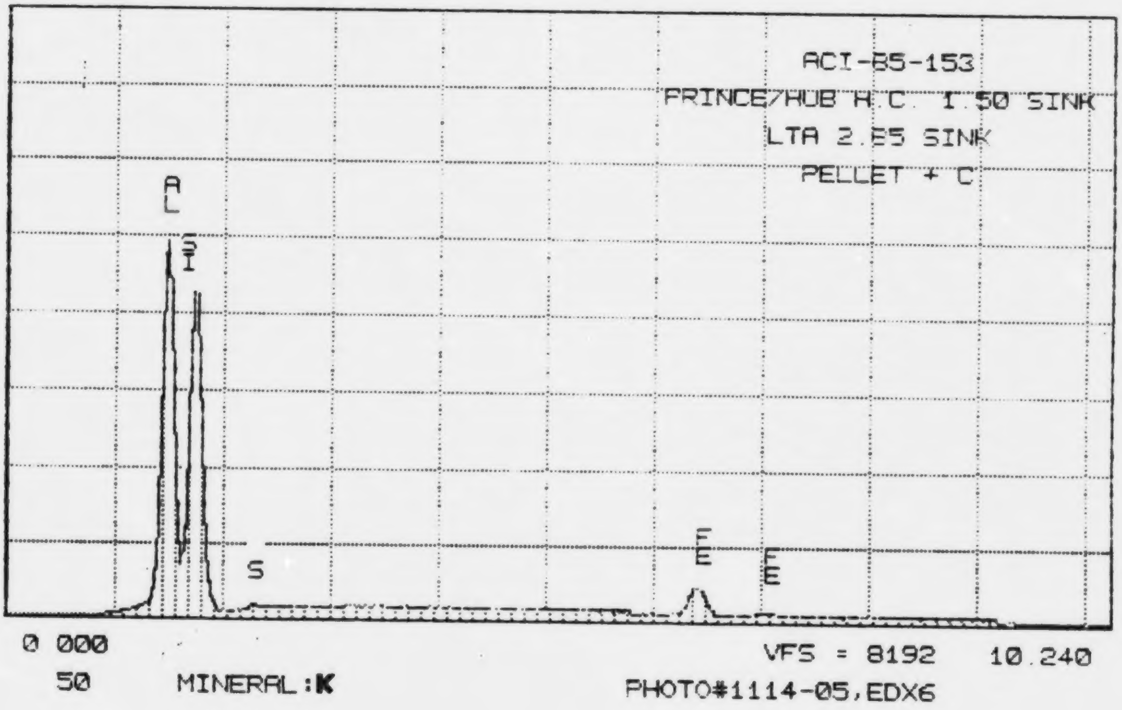
0.000 VFS = 32768 10.240
MINERAL: **Q** PHOTO#1114-05,EDX4 50

ATLANTIC COAL INSTITUTE MON 17-NOV-86 10:46
Cursor: 0.000keV = 0



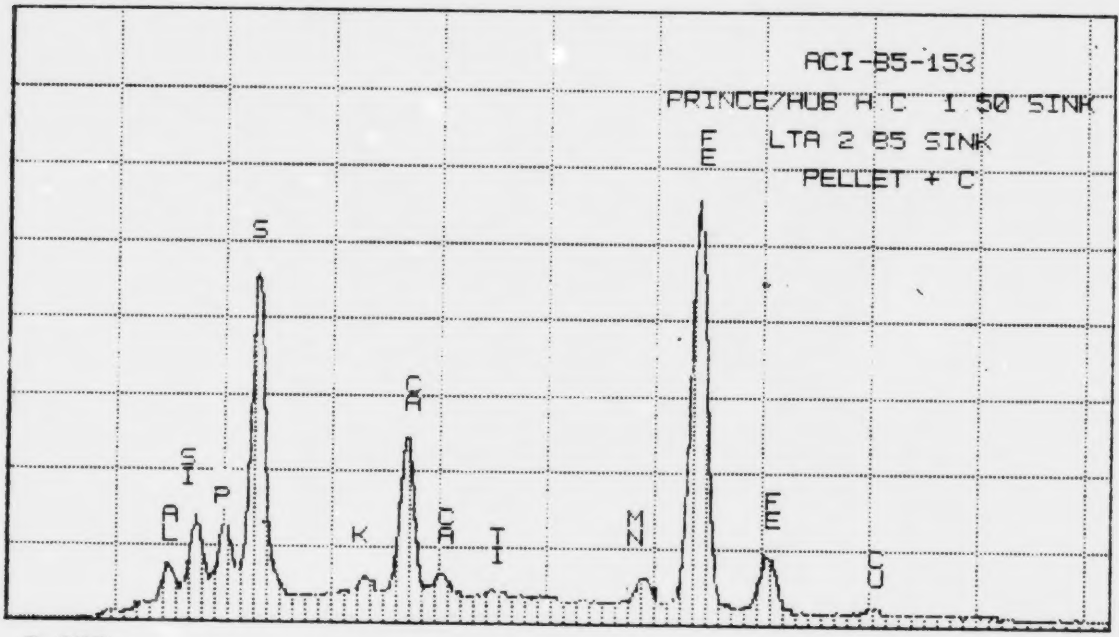
18

ATLANTIC COAL INSTITUTE MON 17-NOV-86 10:53
Cursor: 0.000keV = 0



19

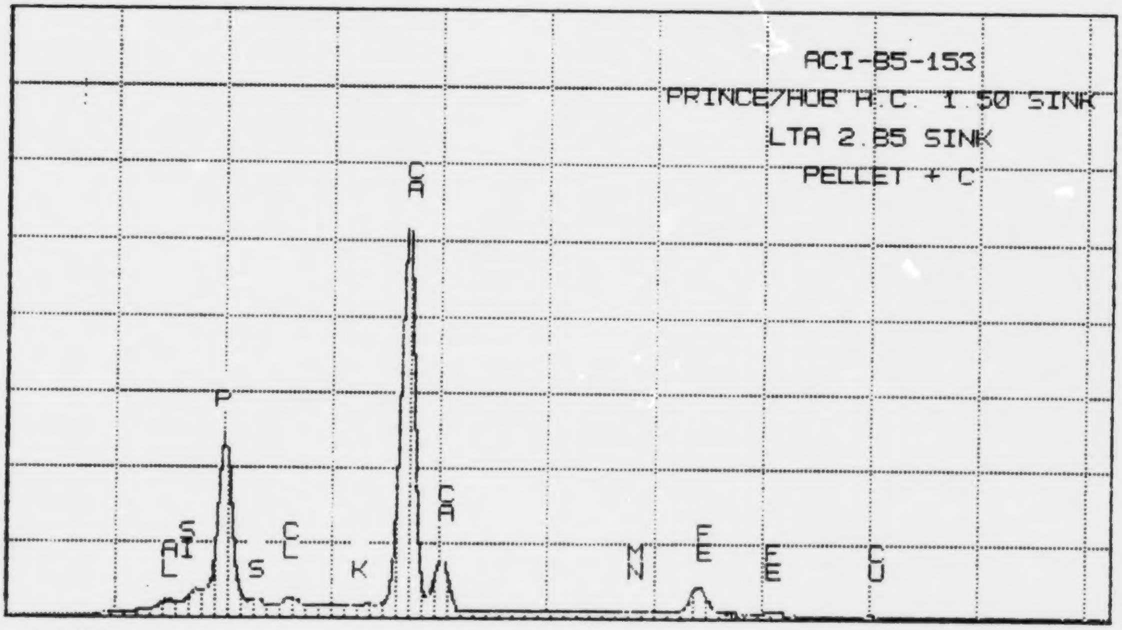
ATLANTIC COAL INSTITUTE MON 17-NOV-86 11:16
Cursor: 0.000keV = 0



20

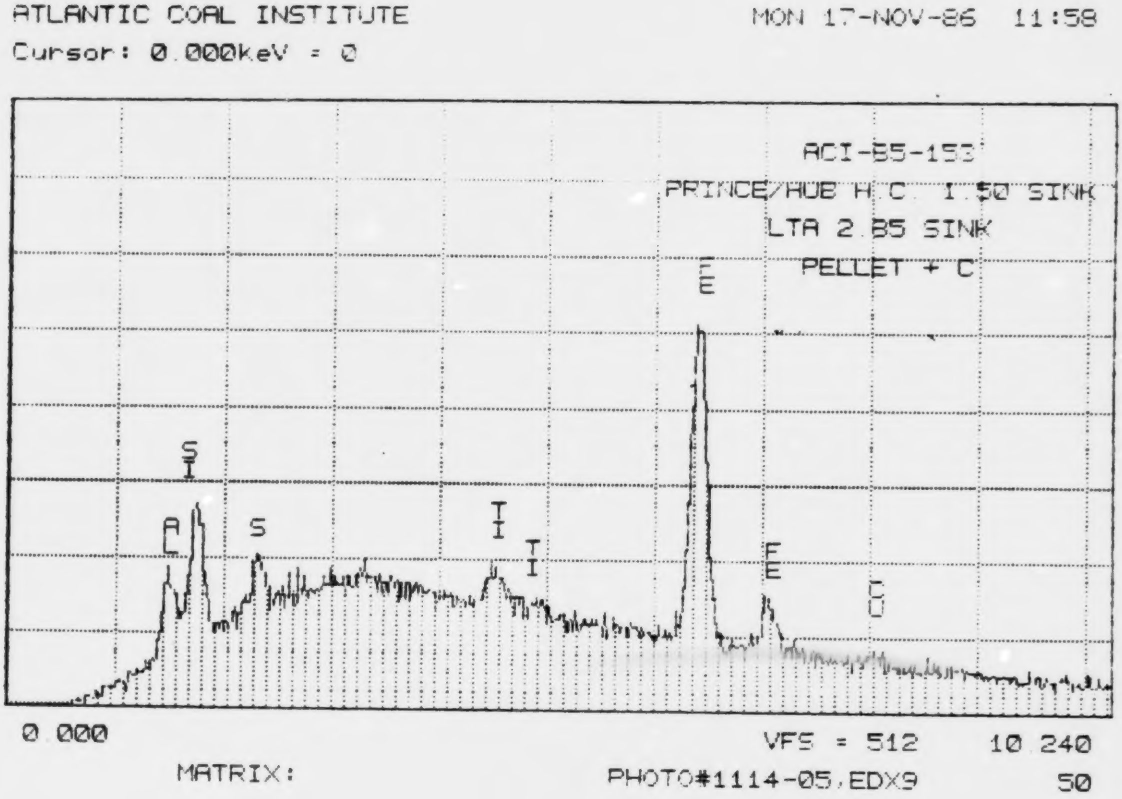
0.000 VFS = 4096 10.240
50 MINERAL: PHOTO#1114-05,EDX7

ATLANTIC COAL INSTITUTE MON 17-NOV-86 11:35
Cursor: 0.000keV = 0



21

0.000 VFS = 16384 10.240
50 MINERAL: **Ap** PHOTO#1114-05,EDX8



ATLANTIC COAL INSTITUTE

MON 17-NOV-86 11:58

Cursor: 0.000keV = 0

0.000

VFS = 512

10.240

MATRIX:

PHOTO#1114-05.EDX9

50

22

PLATE 13

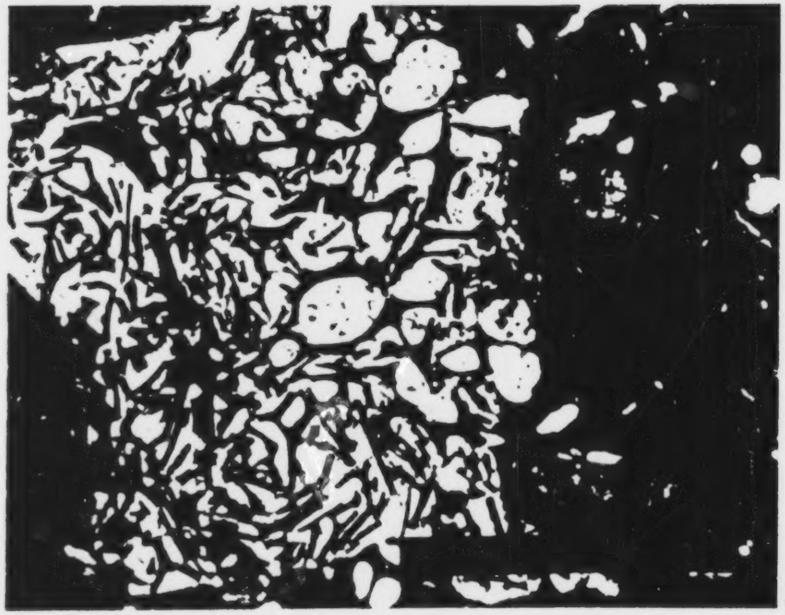
MINERAL ANALYSIS
Prince/Hub -42 mesh to +100 mesh sieve fraction; 1.80 sink
Low Temperature Ashed; float-sunk:
2.00 float; 2.85 float, 2.85 sink

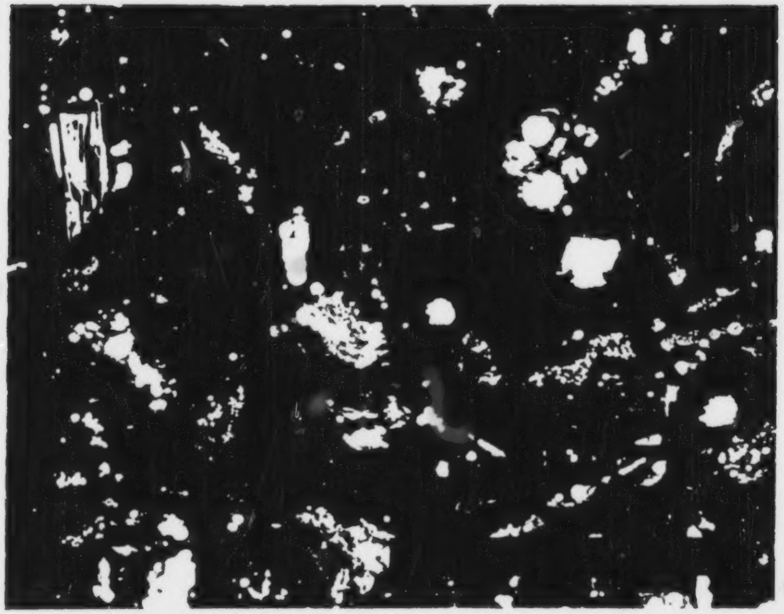
Photo No.	Index No.	Description	Spectra No.
1	1010-05	Original LTA; 100x; BEI	1,2,3,4
2	1010-03	2.85 float; 100x; BEI	6,7,8,9,10
3	1010-04	Enlargement of grain in upper left of P#2. Note "bogen" structure of fusinite, filled with clays. 750x; BEI	9,10
4	1009-02	2.85 sink; 100x; BEI	11,12,13,14
5	1010-01	Enlargement of right side of P#4; 350x; BEI	14

Note: No sample for 2.00 float

1

2

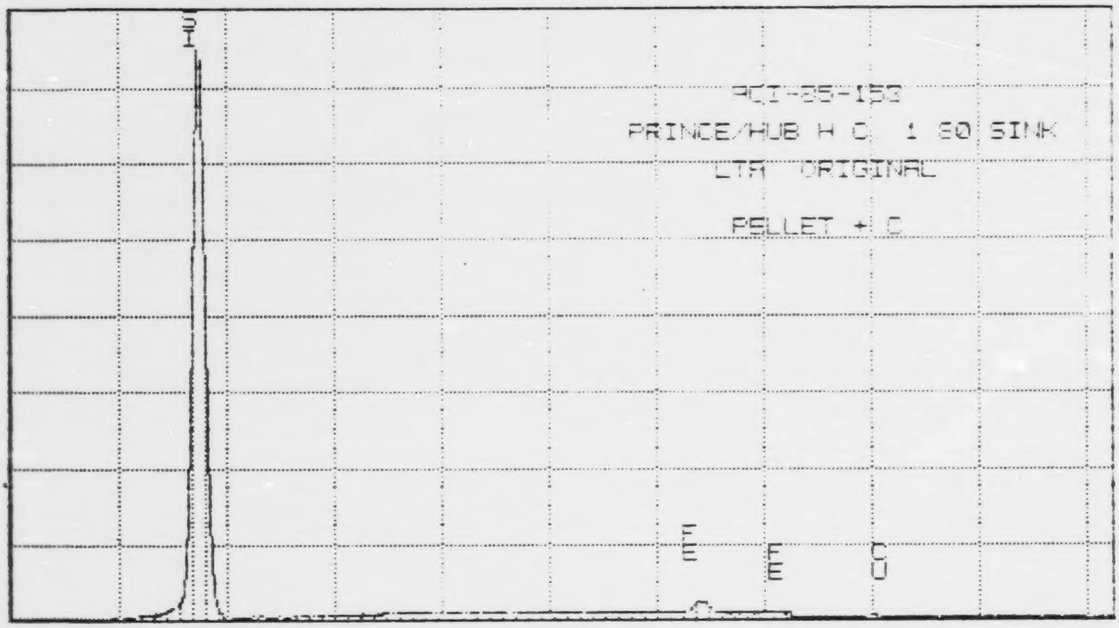

3


4

5

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:22

Cursor: 0.000keV = 0



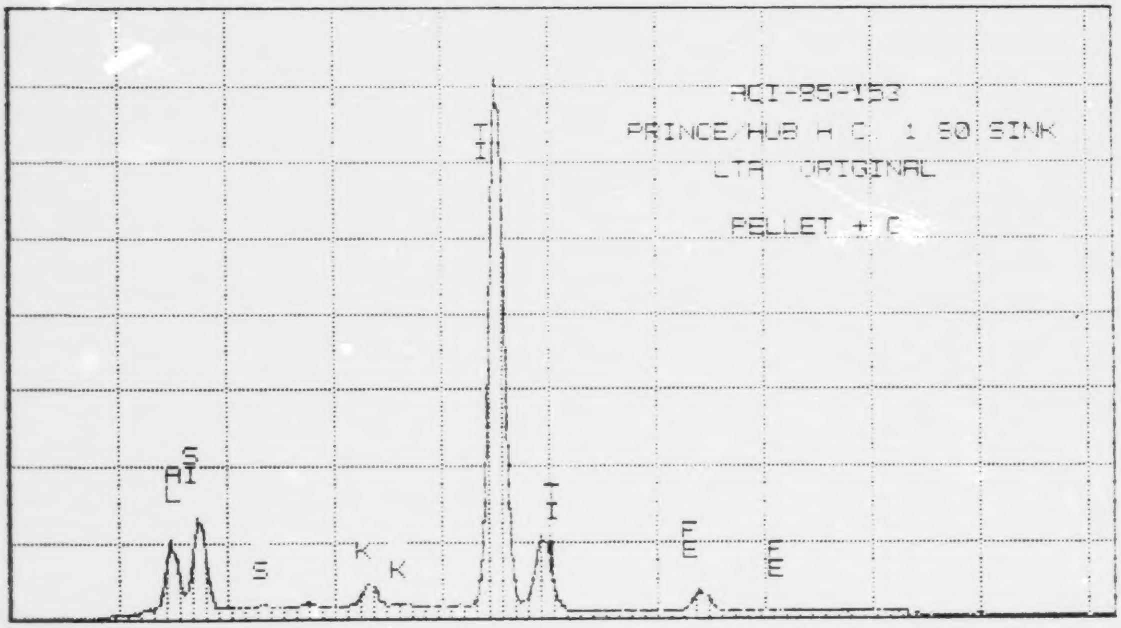
1

0.000 VFS = 8192 10.240

50 MINERAL:**Q** PHOTO#1010-05.EDX1

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:24

Cursor: 0.000keV = 0



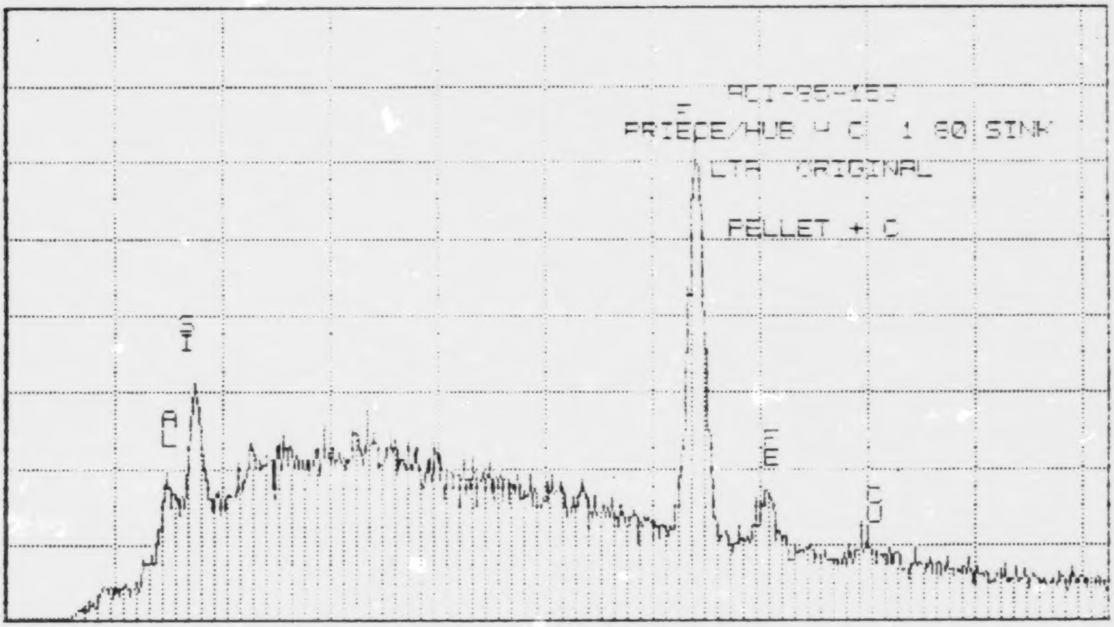
2

0.000 VFS = 8192 10.240

50 MINERAL:**R** PHOTO#1010-05.EDX2

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:26

Cursor: 0.000keV = 0



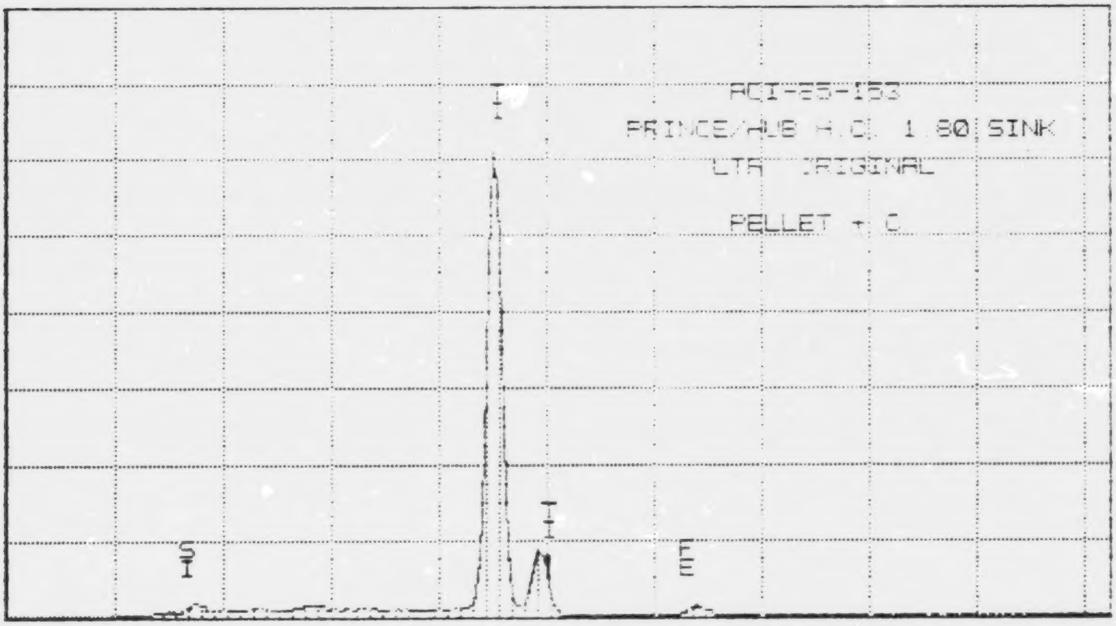
3

0.000 VFS = 256 10.240

50 MATRIX: PHOTO#1010-05.EDX3

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:28

Cursor: 0.000keV = 0



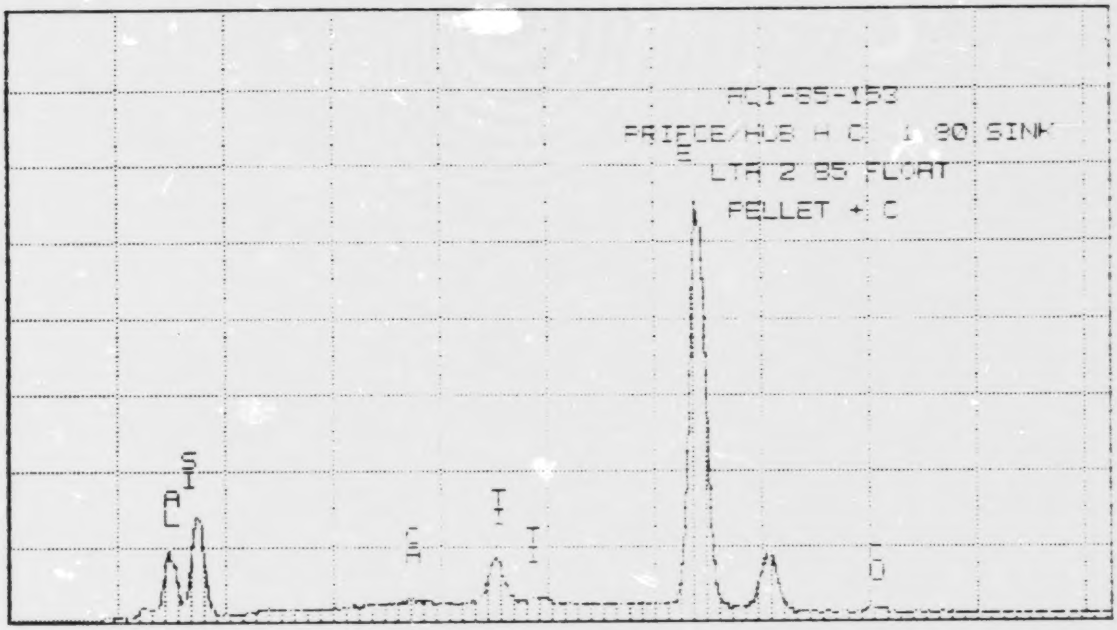
4

0.000 VFS = 16384 10.240

50 MINERAL:**R** PHOTO#1010-05.EDX4

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:00

Cursor: 0.000keV = 0



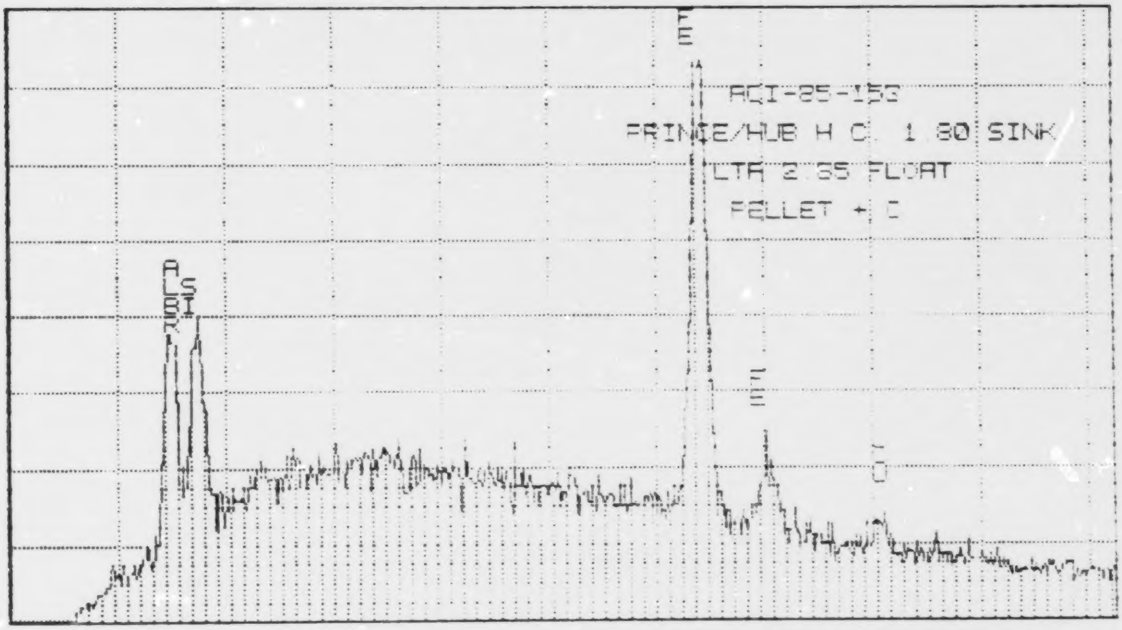
0.000 VFS = 4096 10.240

50 MINERAL: **Sd ?** PHOTO#1010-03.EDX1

5

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:02

Cursor: 0.000keV = 0



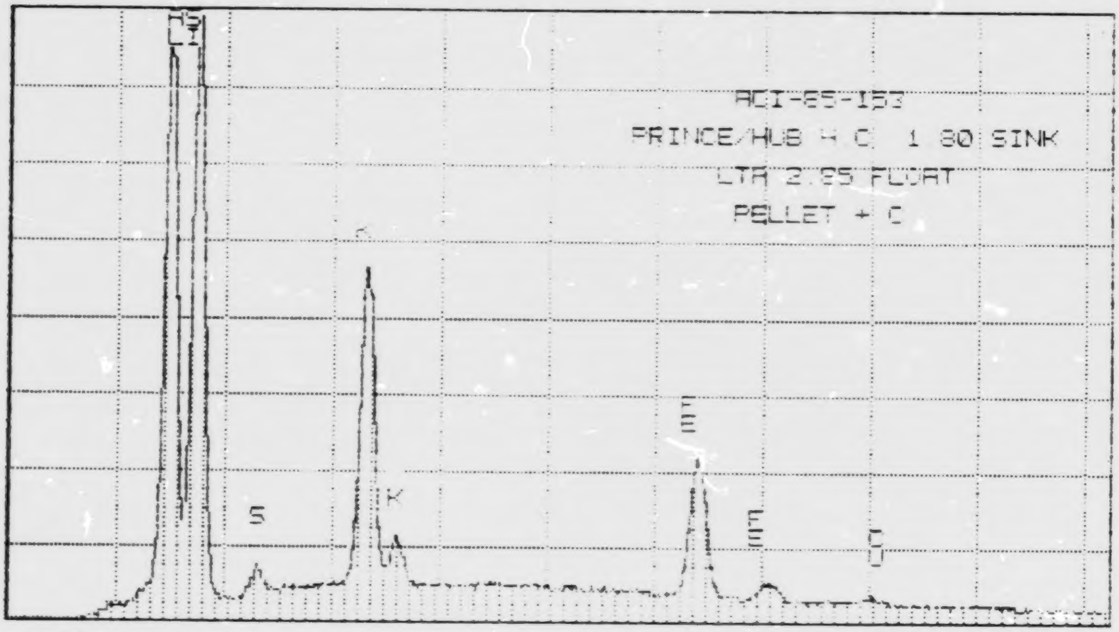
0.000 VFS = 256 10.240

50 MATRIX: PHOTO#1010-03.EDX2

6

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:05

Cursor: 0.000keV = 0



7

0.000 VFS = 2048 10.240

50 MINERAL: **I** PHOTO#1010-03.EDX3

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:07

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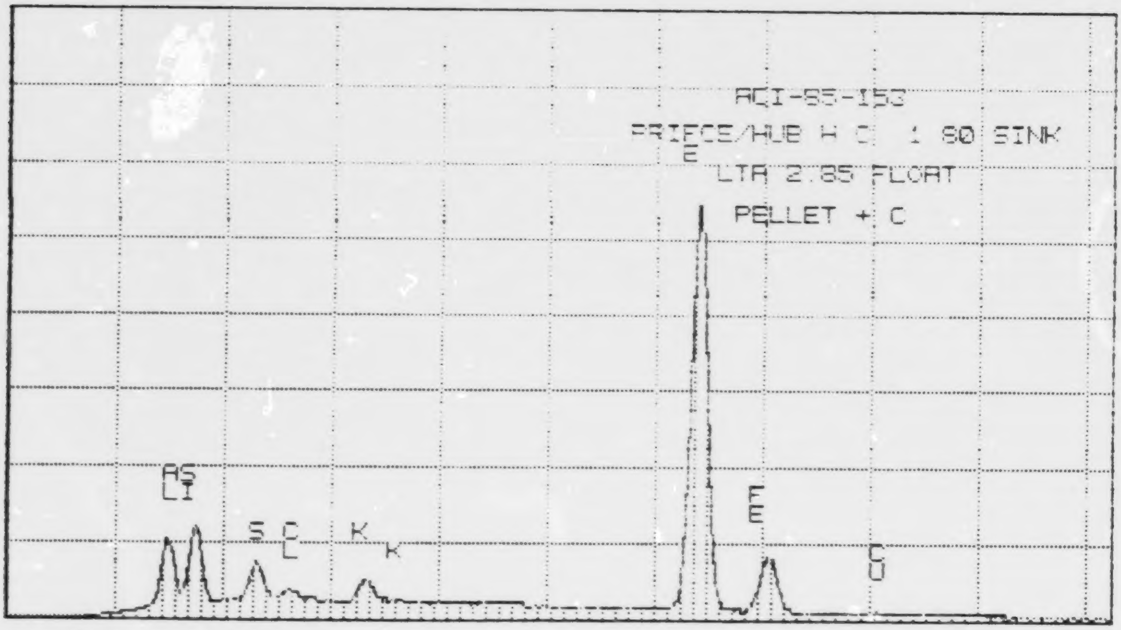

8

0.000 VFS = 8192 10.240

50 MINERAL: **Sd ?** PHOTO#1010-03.EDX4

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:15

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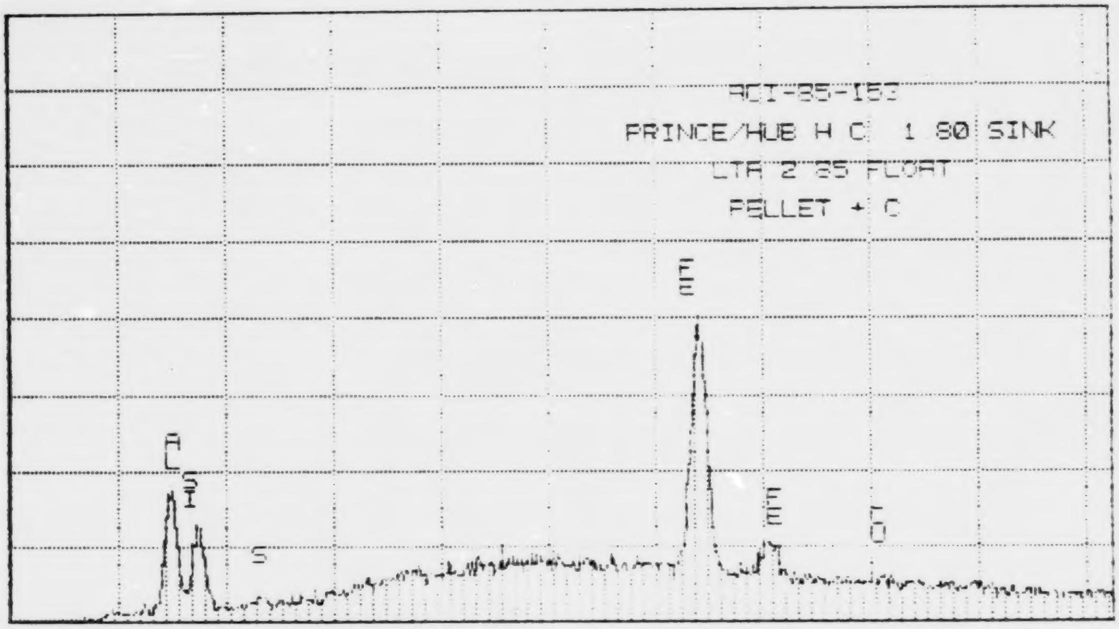


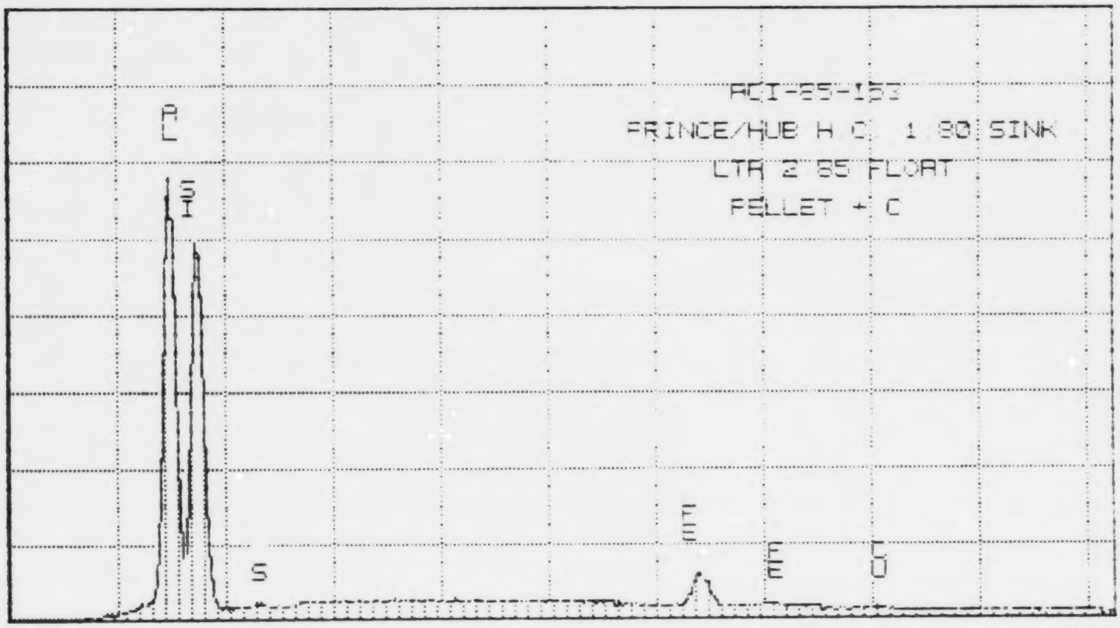
9

0.000 VFS = 512 10.240

50 MATRIX: PHOTO#1010-04.EDX5

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 11:17

Cursor: 0.000keV = 0

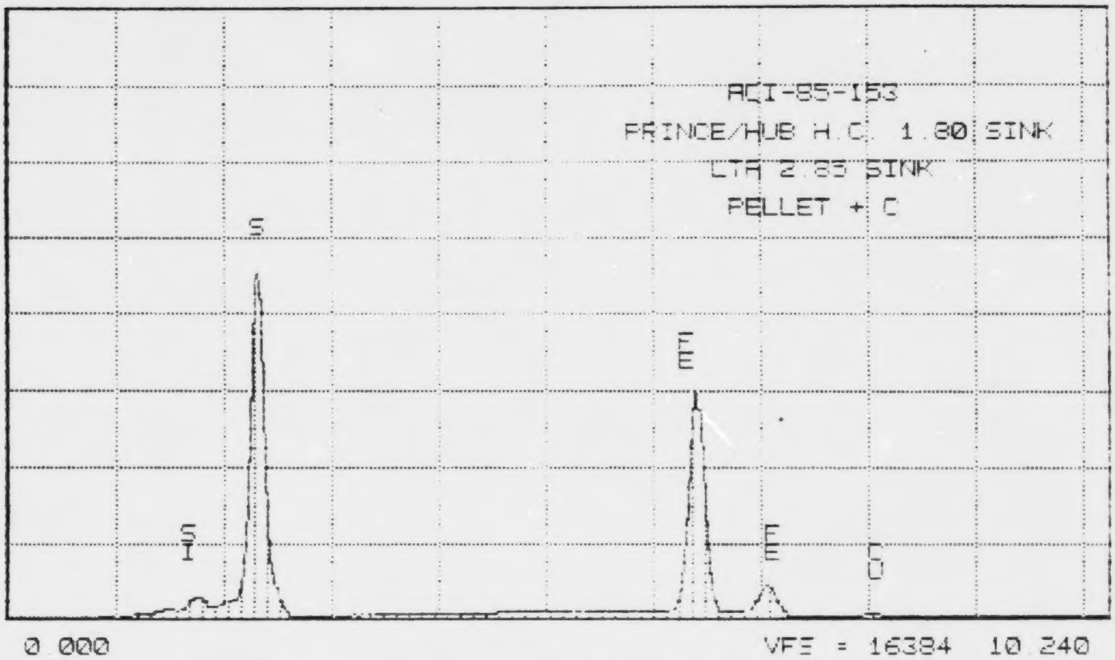


10

0.000 VFS = 4096 10.240

50 MATRIX: K PHOTO#1010-04.EDX6

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:47
Cursor: 0.000keV = 0

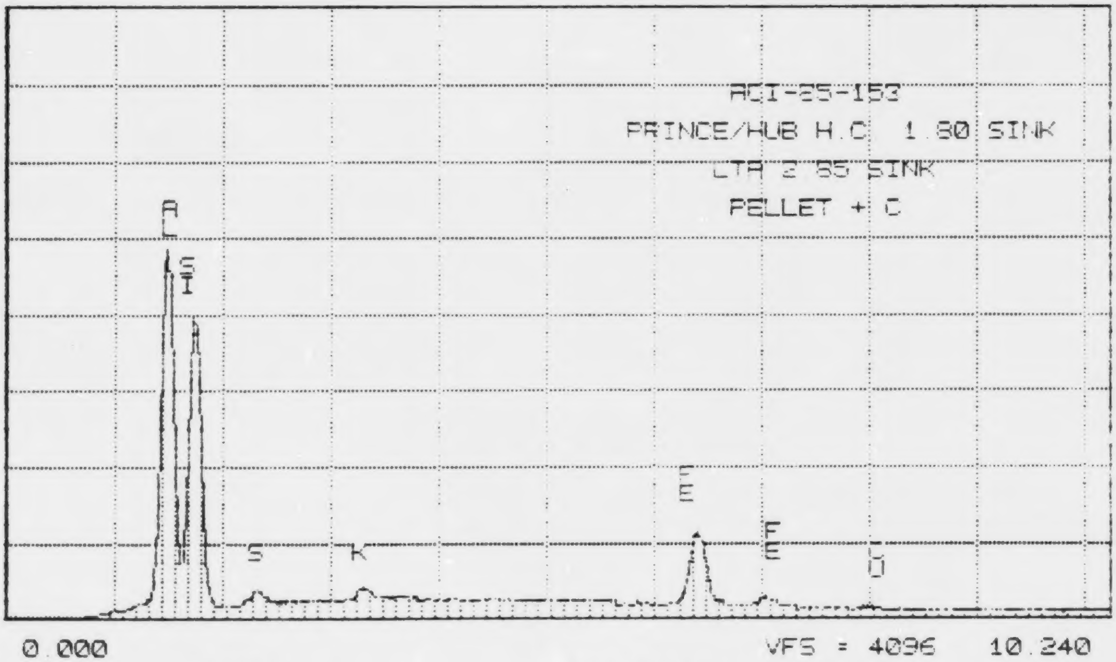


ACI-85-153
PRINCE/HUB H.C. 1.80 SINK
LTA 2.85 SINK
PELLET + C

11

50 MINERAL: **P?** PHOTO#1003-02.EDX1

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:50
Cursor: 0.000keV = 0



ACI-85-153
PRINCE/HUB H.C. 1.80 SINK
LTA 2.85 SINK
PELLET + C

12

50 MINERAL: **I** PHOTO#1003-02.EDX2

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:52
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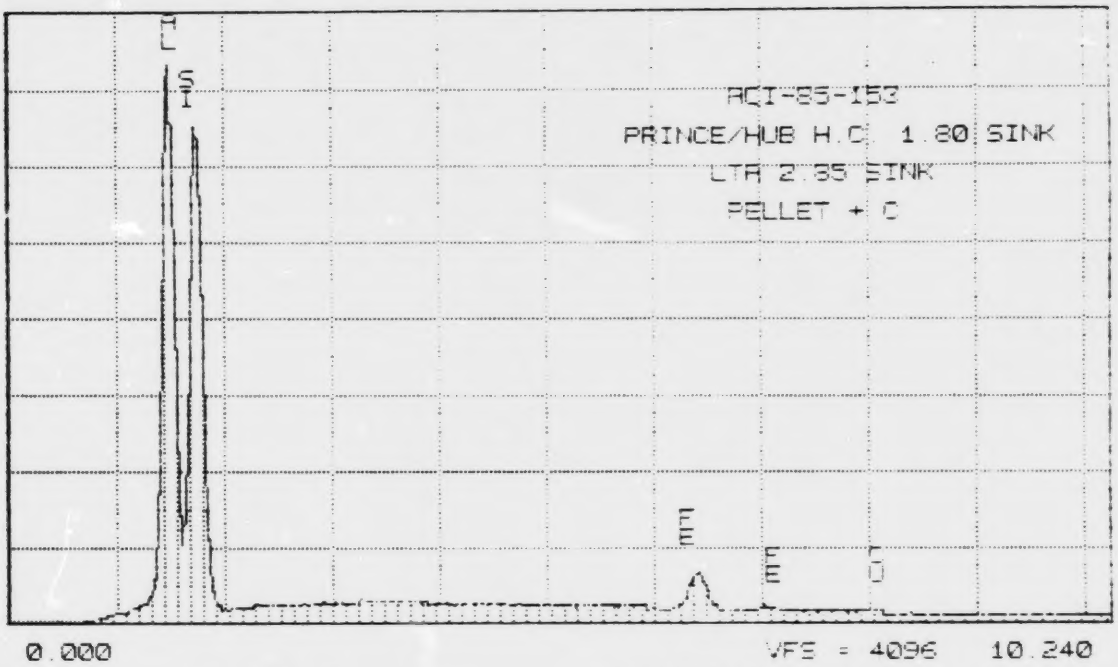

13

50 MINERAL:**K** PHOTO#1009-02.EDX3

ATLANTIC COAL INSTITUTE FRI 17-OCT-86 10:54
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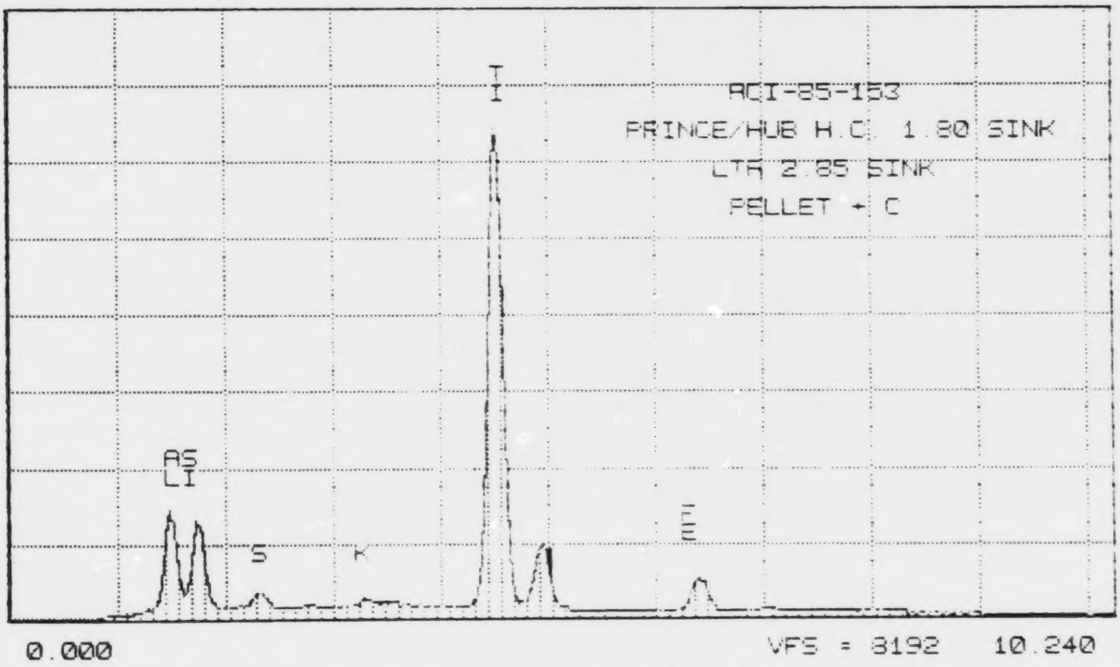


14

50 MINERAL:**R** PHOTO#1010-01.EDX4

PLATE 14

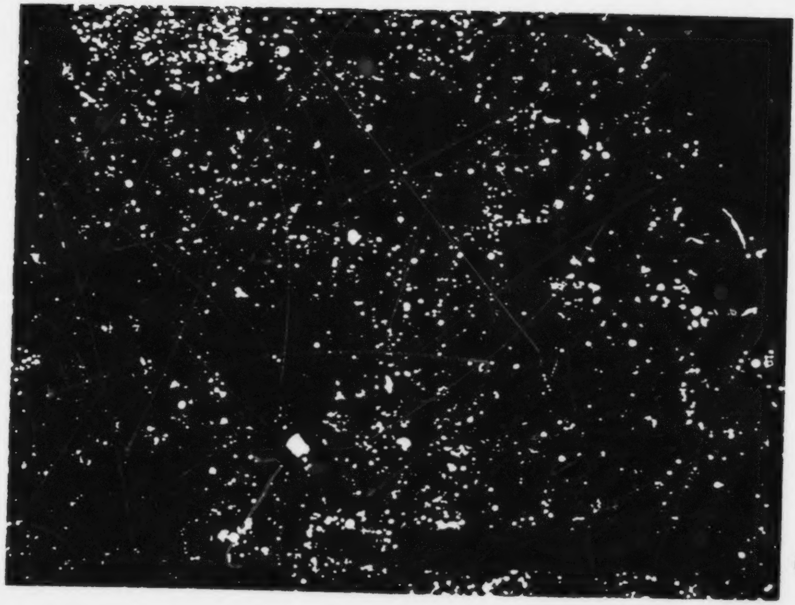
MINERAL ANALYSIS
Minto/Chipman #2, -42 mesh to +100 mesh sieve fraction; 1.30 float
Low Temperature Ashed; float-sunk:
2.00 float; 2.85 float, 2.85 sink

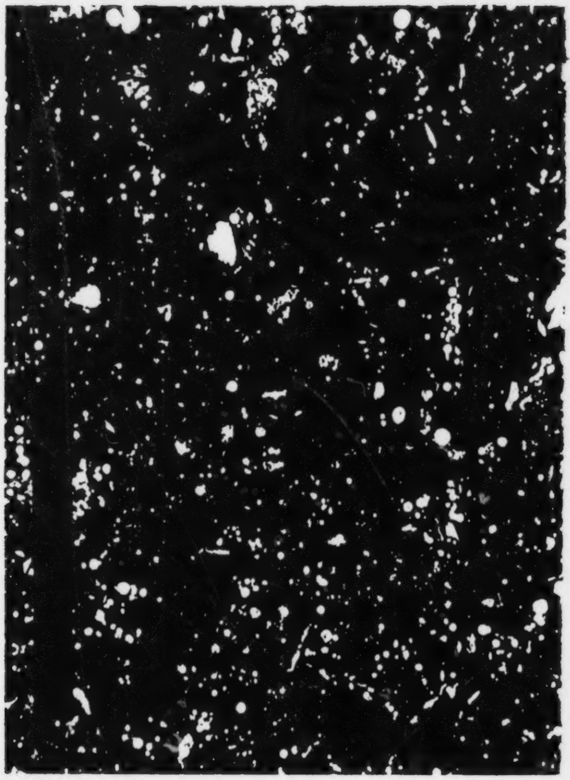
Photo No.	Index No.	Description	Spectra No.
1	1128-04	Original LTA; 100x; BEI	1,2,3,4,5,6,7,8 9,10,11,12
2	1201-07	Enlargement of grain in upper left of P#1; 500x, BEI	1,2,3,4
3	1128-05	2.00 float; 100x; BEI	13,14,15,16,17 18,19
4	1128-06	2.85 float; 100x; BEI	20,21,22,23,24 25,26,27
5	1201-02	2.85 sink; 100x; BEI	28,29,30,31,32

1

2

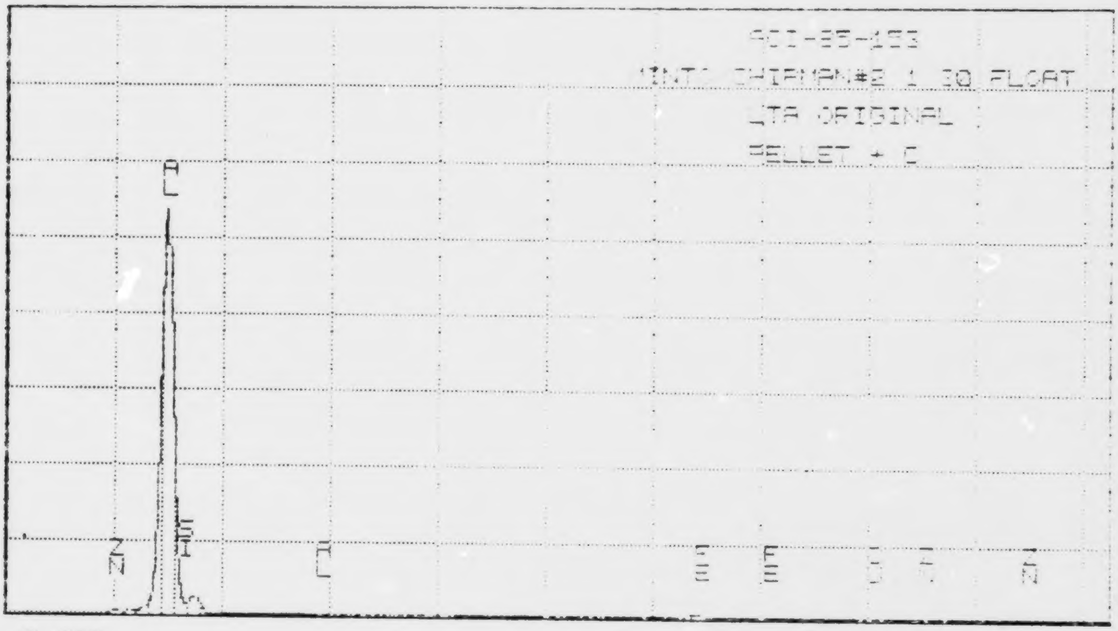
3


4



5

ATLANTIC COAL INSTITUTE   TUE 02-DEC-86 16:10
Cursor: 0.000keV = 0



1

0.000   VFS = 16384 10.240
50   MINERAL: PHOTO#1128-04.EDX1

ATLANTIC COAL INSTITUTE   TUE 02-DEC-86 16:13
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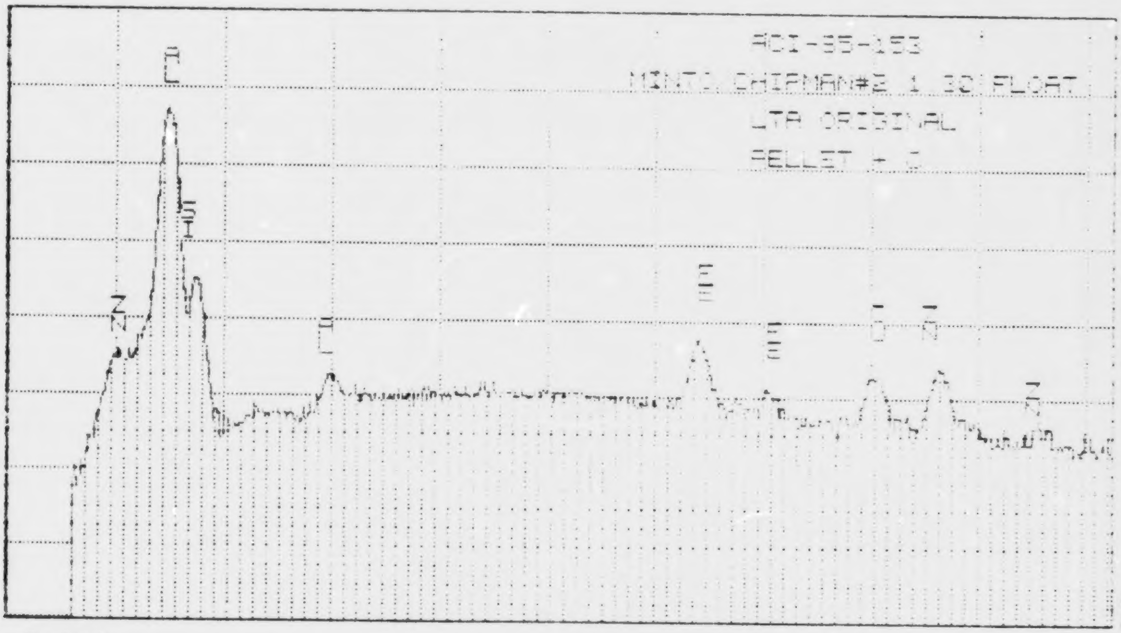
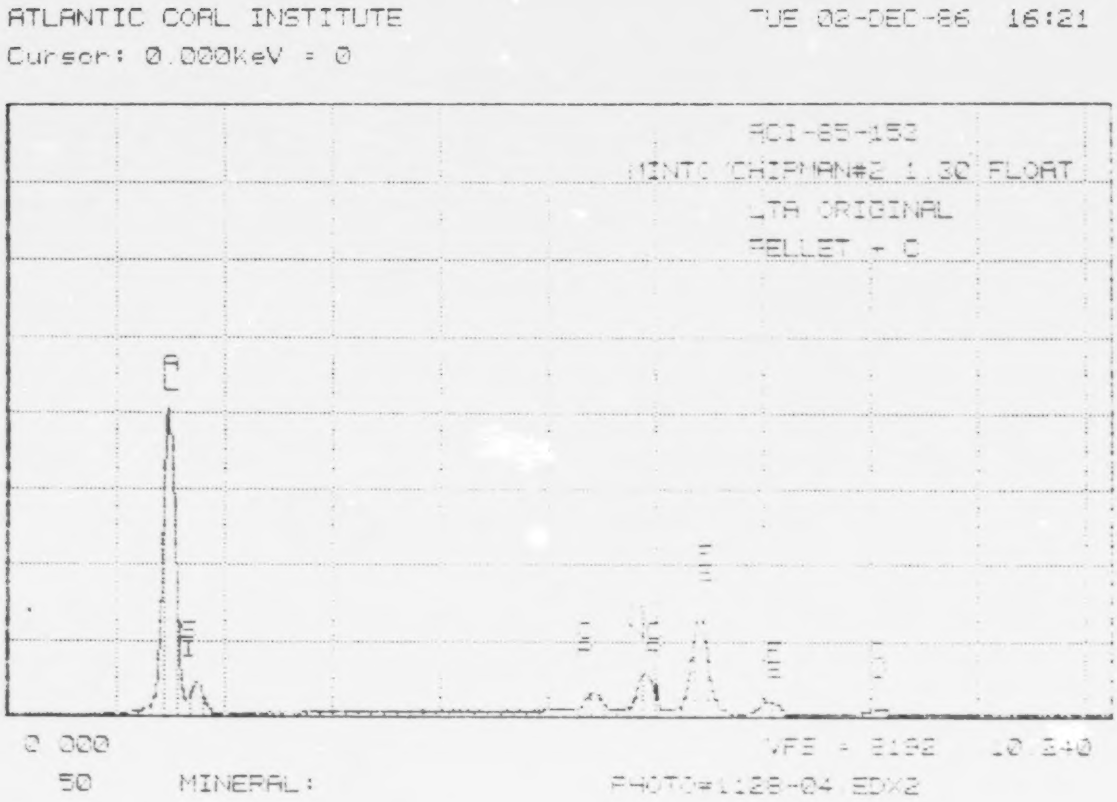


2

0.000   VFS = LOG 1 10.240
50   MINERAL: PHOTO#1128-04.EDX1

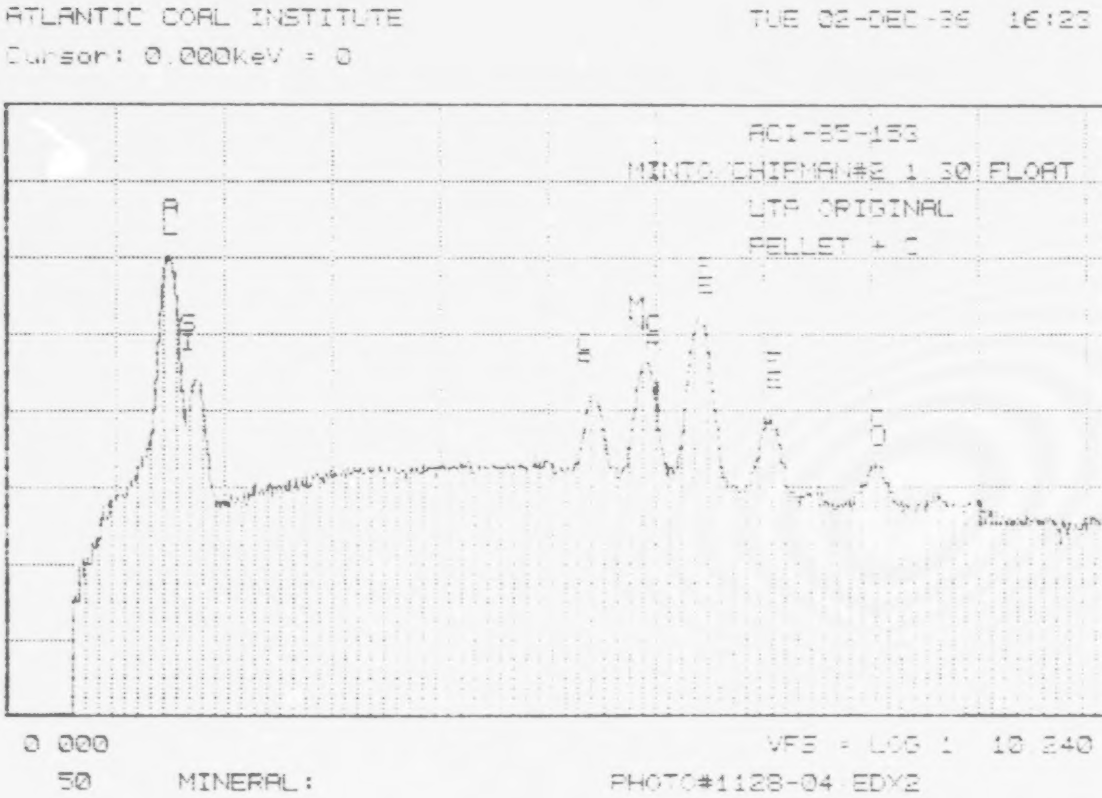


ATLANTIC COAL INSTITUTE TUE 02-DEC-86 16:21
Cursor: 0.000keV = 0

ACI-85-152
MINTO CHIPMAN#2 1.30 FLOAT
LTA ORIGINAL
PELLET + C

0.000 VFS = 8192 10.240
50 MINERAL: PHOTO#1128-04 EDX2

3



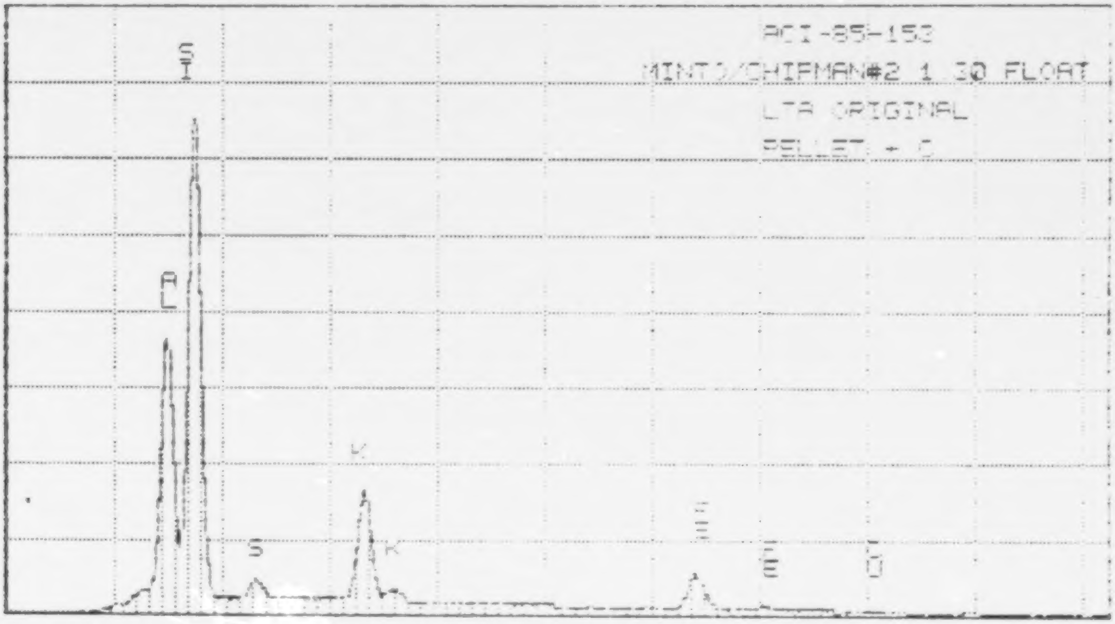
ATLANTIC COAL INSTITUTE TUE 02-DEC-86 16:23
Cursor: 0.000keV = 0

ACI-85-153
MINTO CHIPMAN#2 1.30 FLOAT
LTA ORIGINAL
PELLET + C

0.000 VFS = LOG 1 10.240
50 MINERAL: PHOTO#1128-04 EDX2

4

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:29
Cursor: 0.000keV = 0

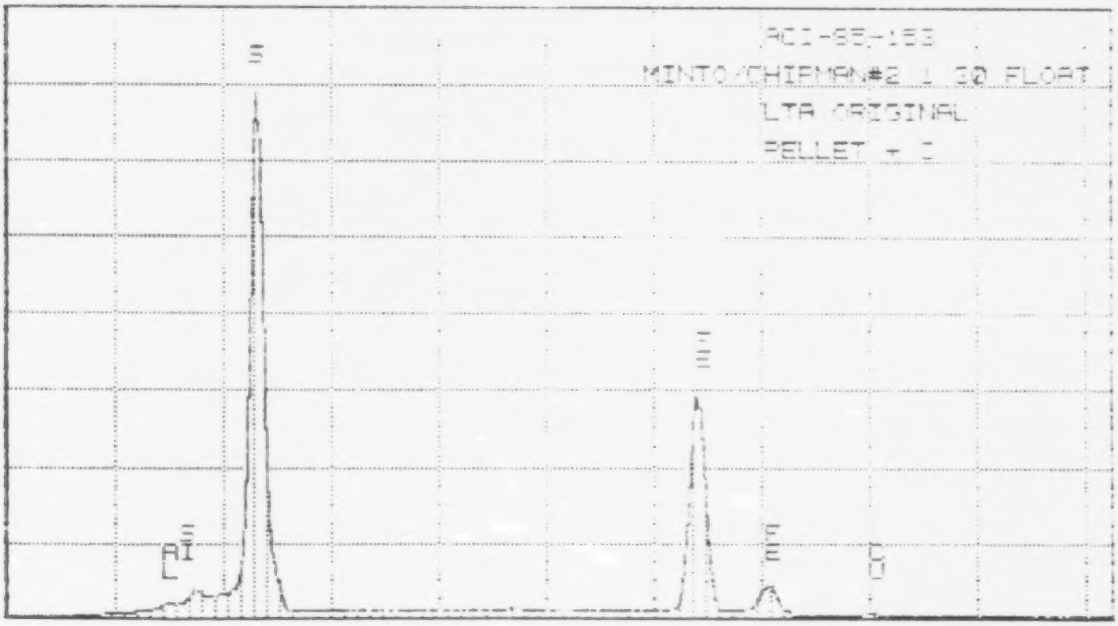


ACI-85-153
MINTO/CHIPMAN#2 1.30 FLOAT
LTA ORIGINAL
PELLET + C

5

0.000 VFS = 4096 10.240
50 MINERAL: I PHOTO#1128-04.EDX3

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:31
Cursor: 0.000keV = 0



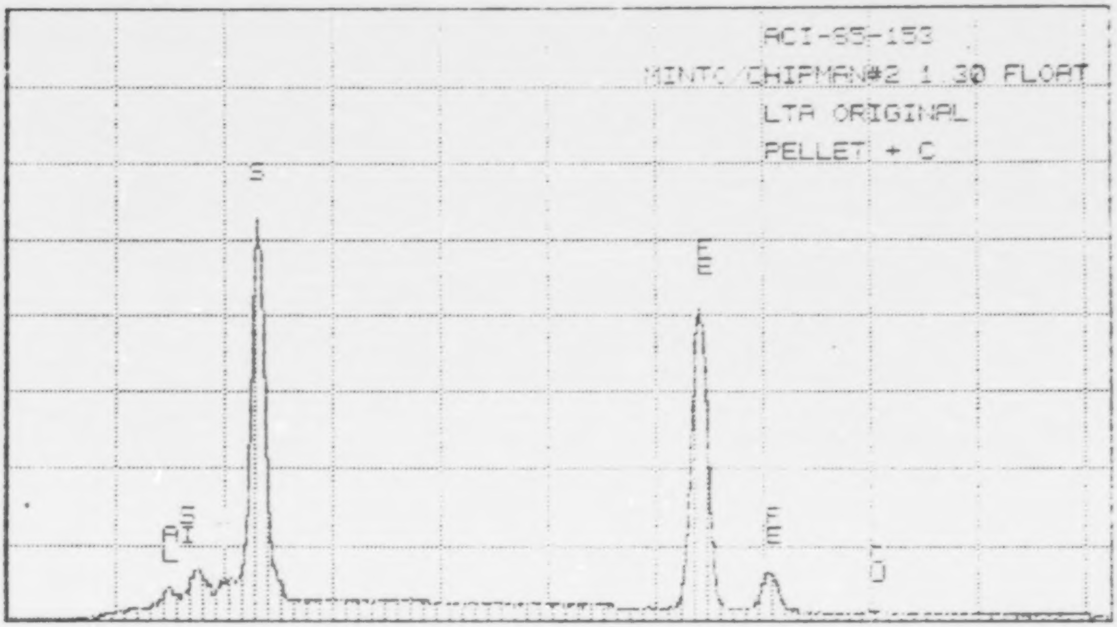
ACI-85-153
MINTO/CHIPMAN#2 1.30 FLOAT
LTA ORIGINAL
PELLET + C

6

0.000 VFS = 8192 10.240
50 MINERAL: P PHOTO#1128-04.EDX4

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:33

Cursor: 0.000keV = 0



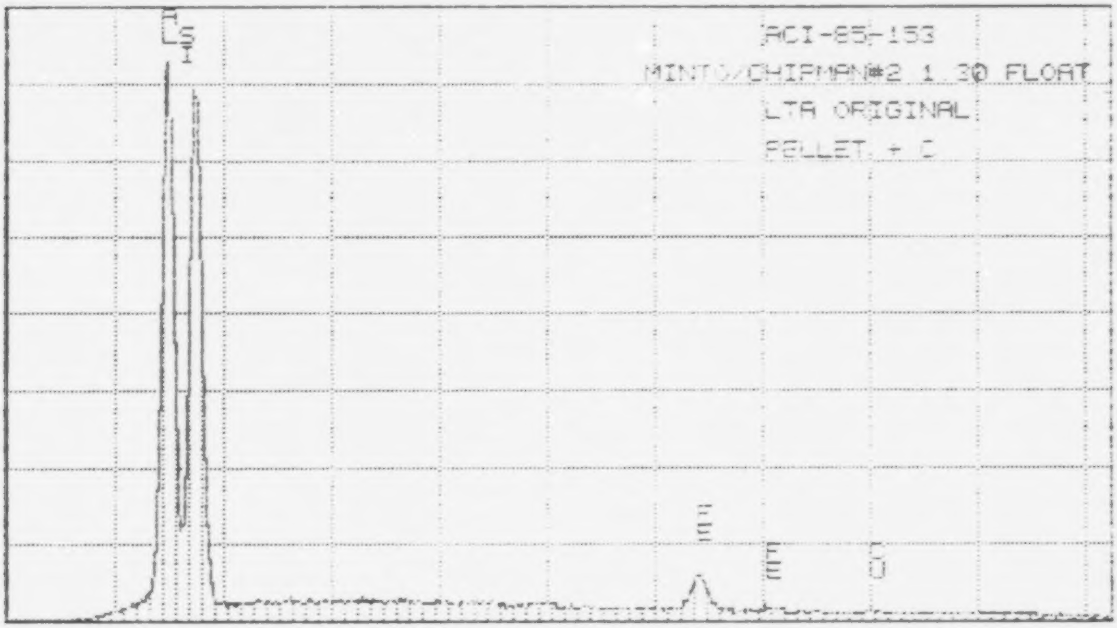
7

0.000 VFS = 2048 10.240

50 MINERAL: PHOTO#1128-04,EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:36

Cursor: 0.000keV = 0



8

0.000 VFS = 2048 10.240

50 MINERAL: K PHOTO#1128-04,EDX6

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:38
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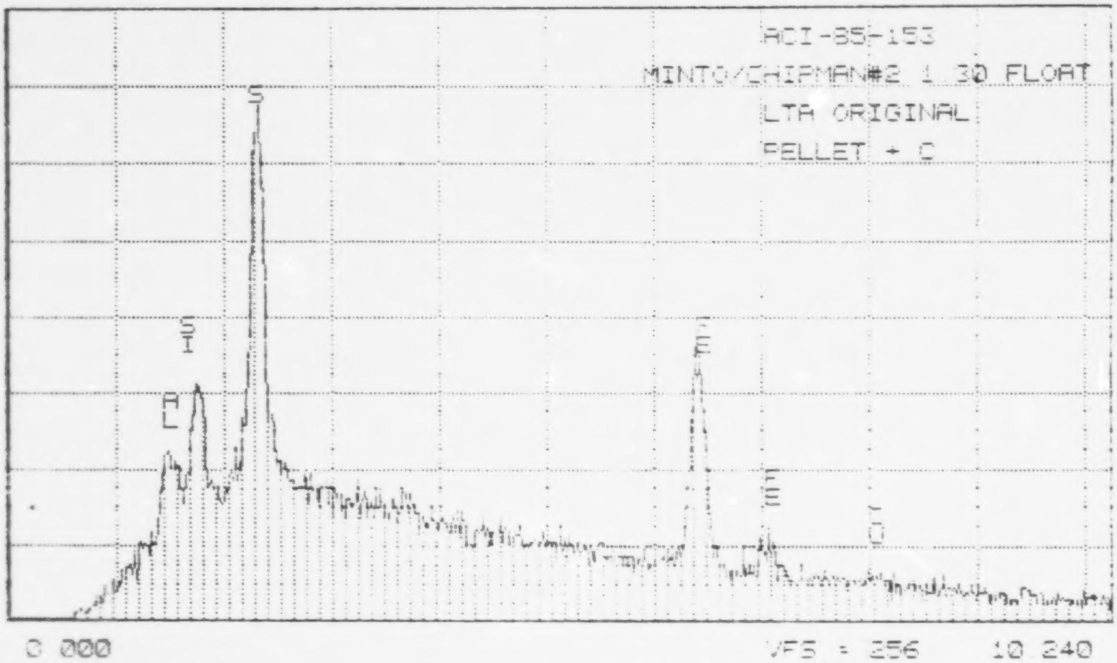
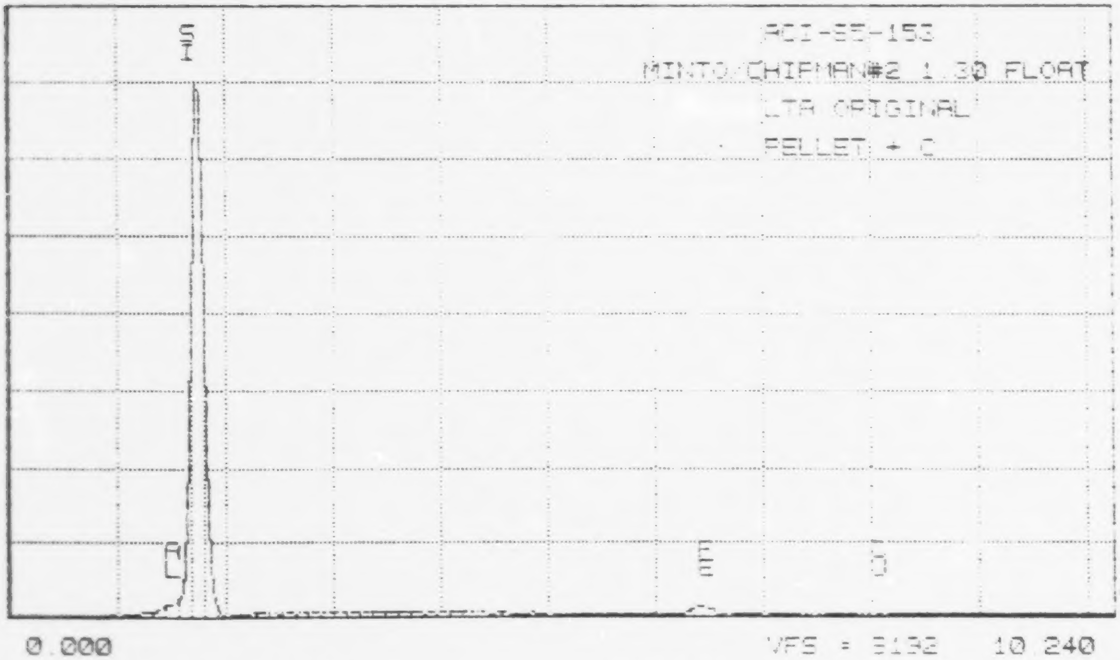


9

50 MATRIX: PHOTO#1128-04.EDX7

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:40
Cursor: 0.000keV = 0



10

50 MINERAL:**Q** PHOTO#1128-04.EDX8

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:42

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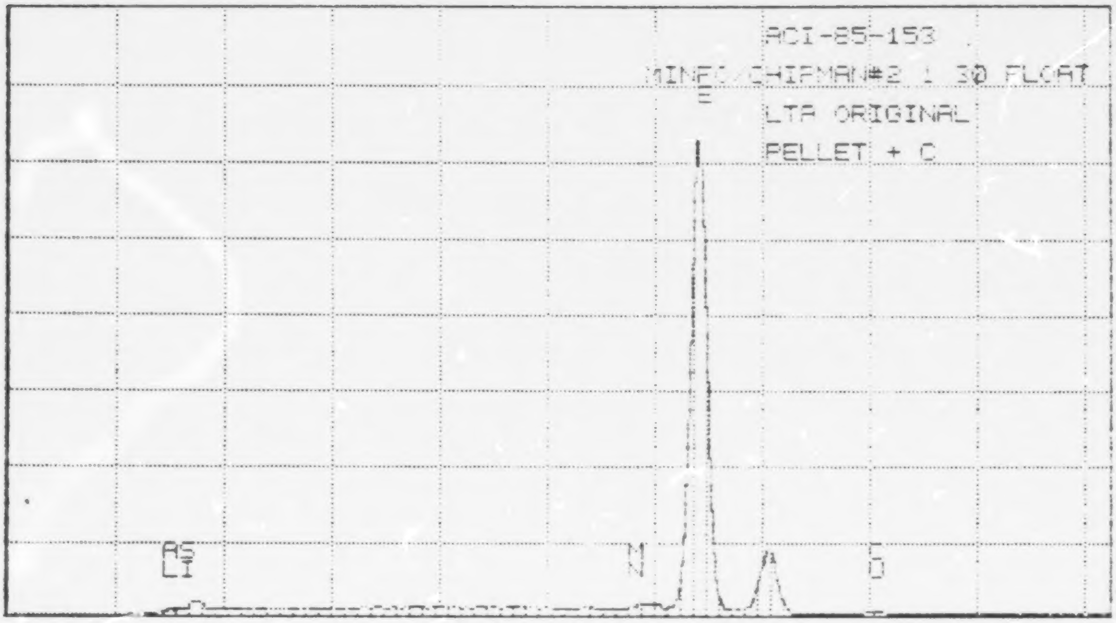

11

0.000 VFS = 8192 10.240

51 MINERAL: **Sd** PHOTO#1128-04.EDX9

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:44

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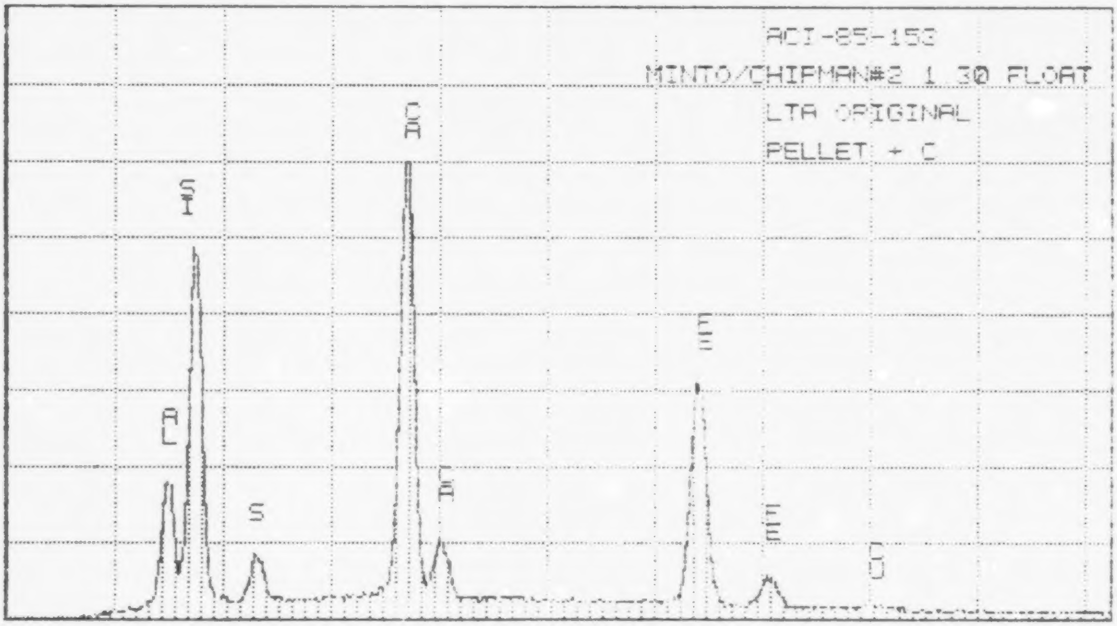
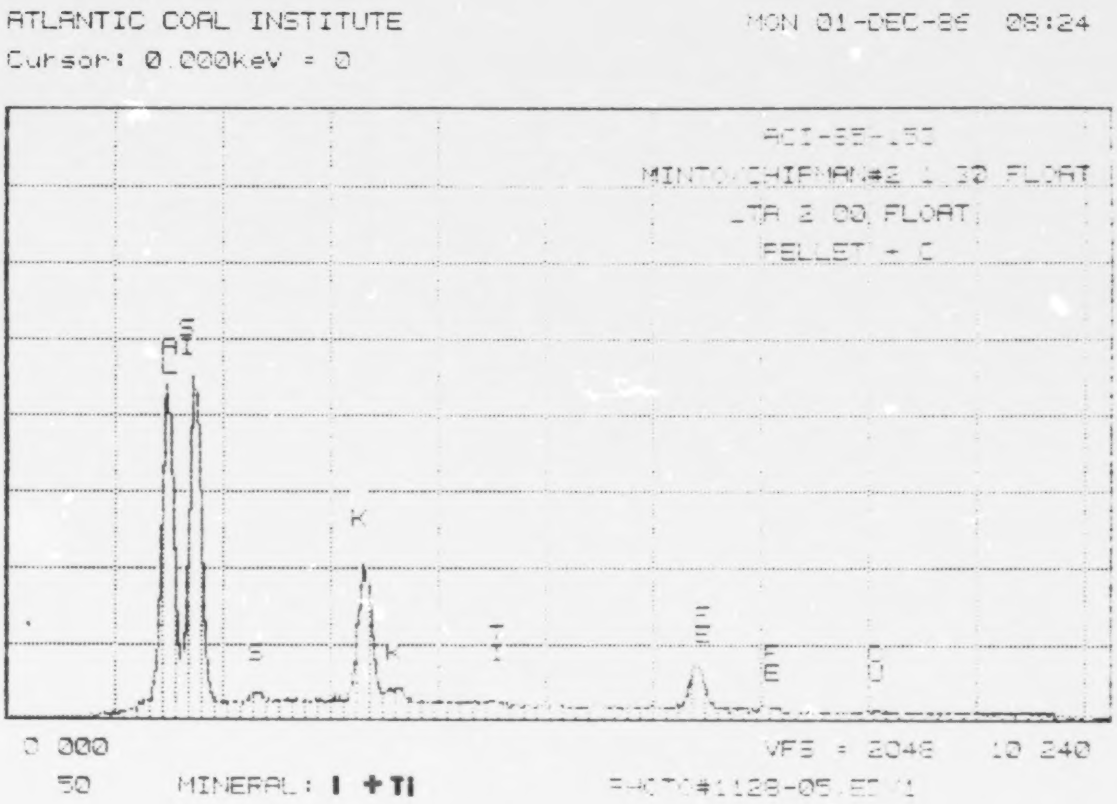


12

0.000 VFS = 2048 10.240

51 MINERAL: PHOTO#1128-04.EDX10



ATLANTIC COAL INSTITUTE MON 01-DEC-86 08:24

Cursor: 0.000keV = 0

ACI-85-151

MINTO/CHIPMAN#2 1.30 FLOAT

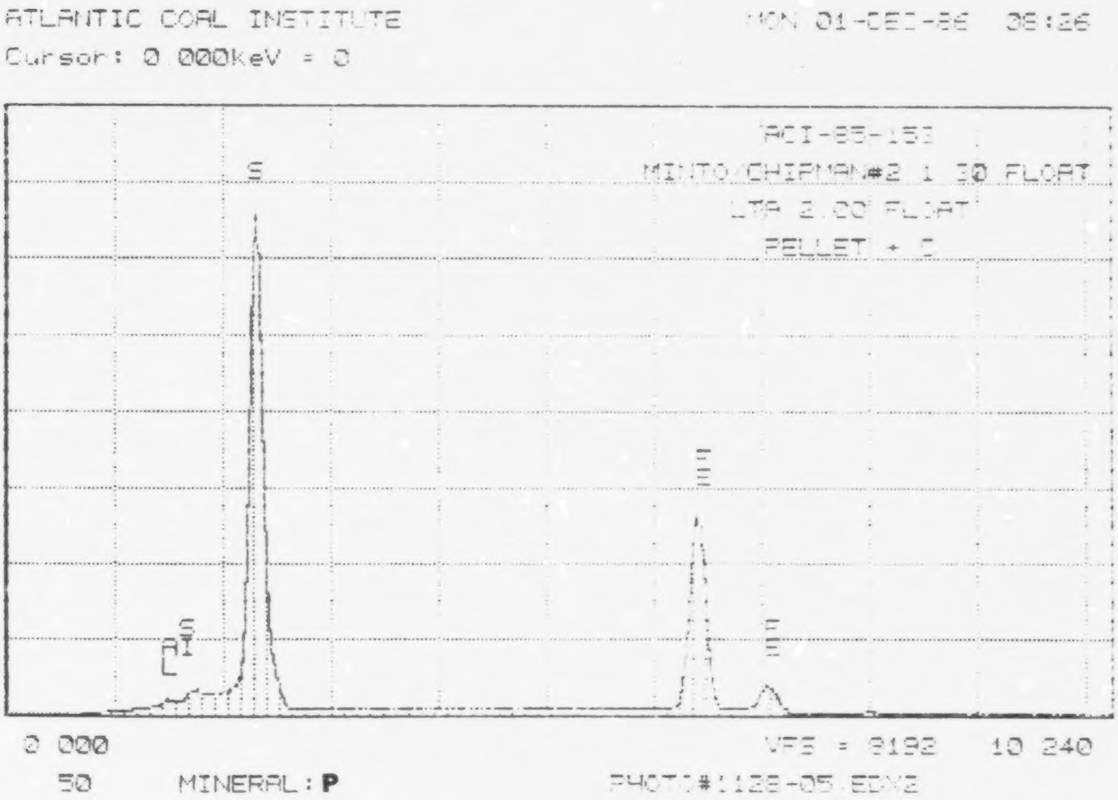
LTA 2.00 FLOAT

PELLET + C

0.000 VFS = 2048 10.240

50 MINERAL: **I +TI** PHOTO#1128-05.EDX1

13



ATLANTIC COAL INSTITUTE MON 01-DEC-86 08:26

Cursor: 0.000keV = 0

ACI-85-151

MINTO/CHIPMAN#2 1.30 FLOAT

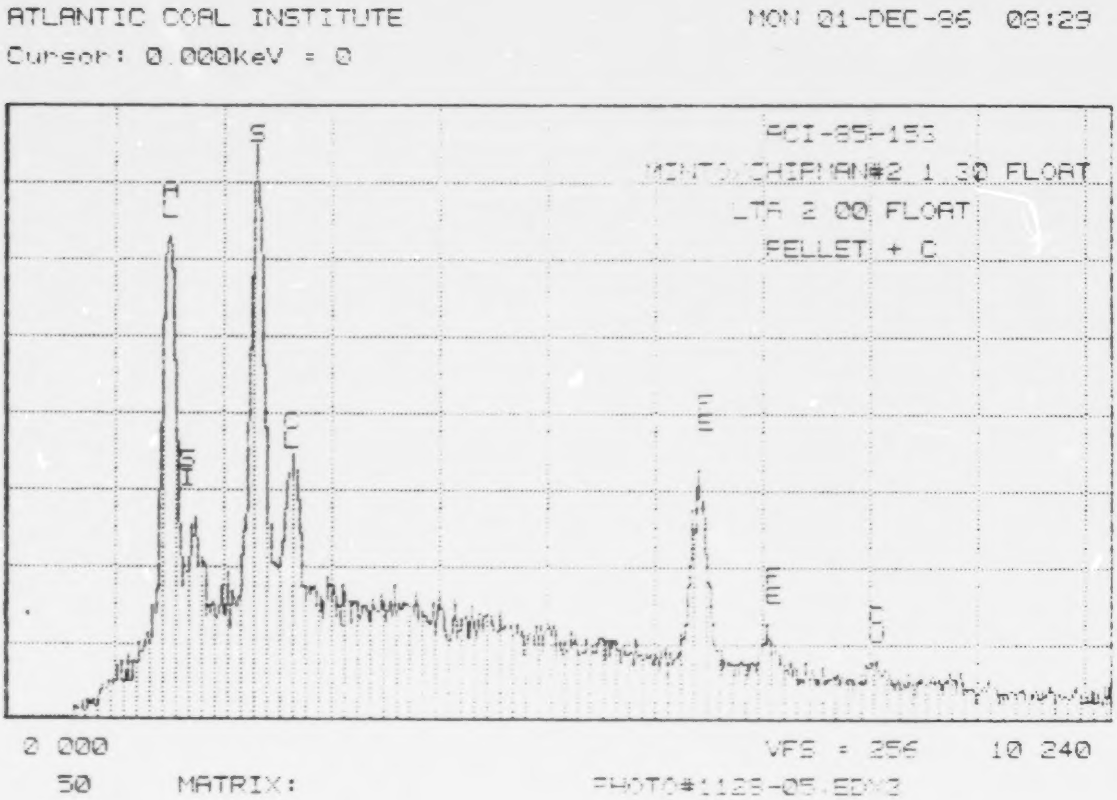
LTA 2.00 FLOAT

PELLET + C

0.000 VFS = 8192 10.240

50 MINERAL: **P** PHOTO#1128-05.EDX2

14



ATLANTIC COAL INSTITUTE MON 01-DEC-86 08:29

Cursor: 0.000keV = 0

ACI-85-153

MINTO/CHIPMAN#2 1.30 FLOAT

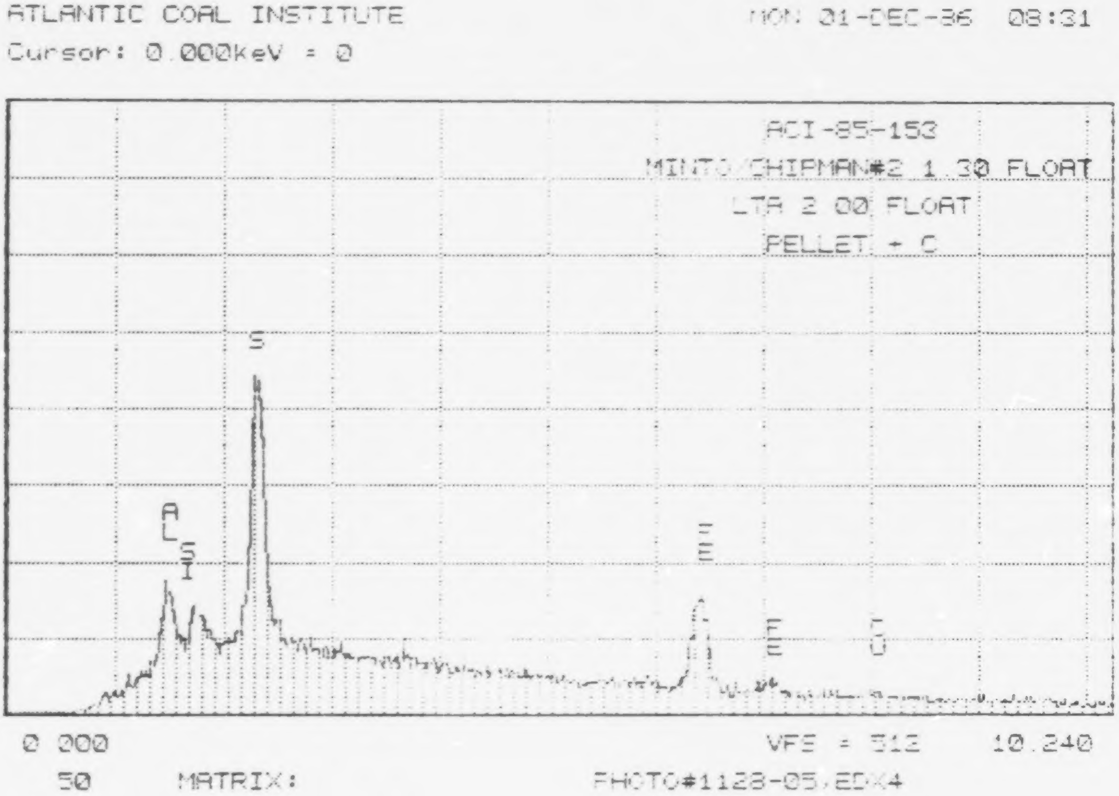
LTA 2.00 FLOAT

PELLET + C

0.000 VFS = 256 10.240

50 MATRIX: PHOTO#1128-05.EDX3

15



ATLANTIC COAL INSTITUTE MON 01-DEC-86 08:31

Cursor: 0.000keV = 0

ACI-85-153

MINTO/CHIPMAN#2 1.30 FLOAT

LTA 2.00 FLOAT

PELLET + C

0.000 VFS = 512 10.240

50 MATRIX: PHOTO#1128-05.EDX4

16

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:38
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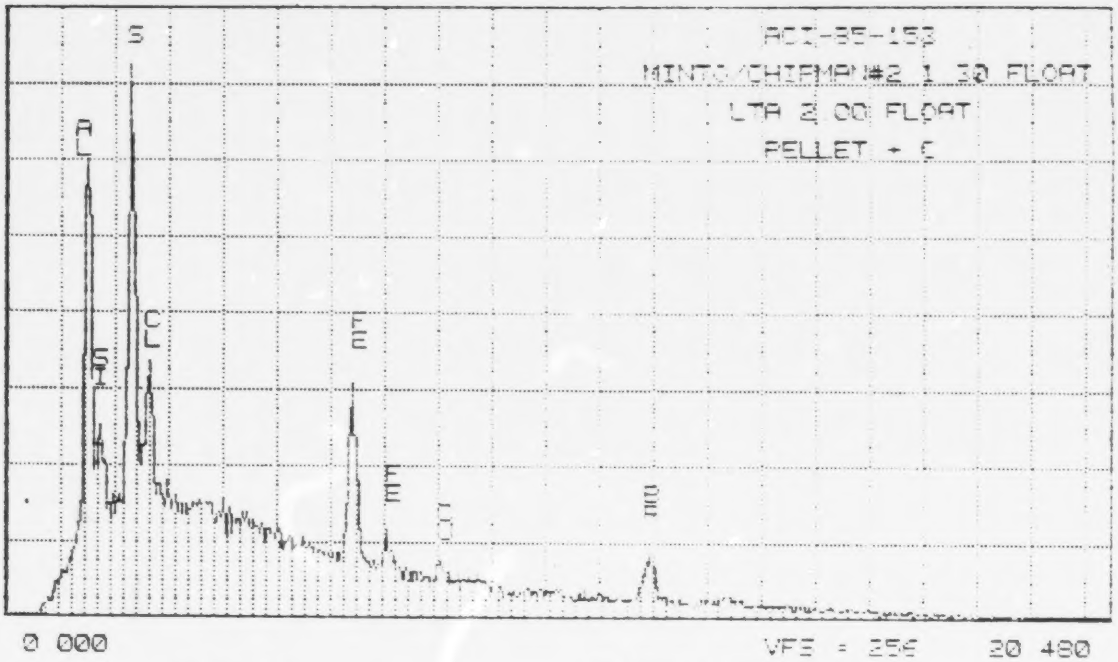

ACI-85-153
MINTO/CHIPMAN#2 1 30 FLOAT
LTA 2.00 FLOAT
PELLET + C

17

50 MATRIX: PHOTO#1128-05.EDX3

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:43
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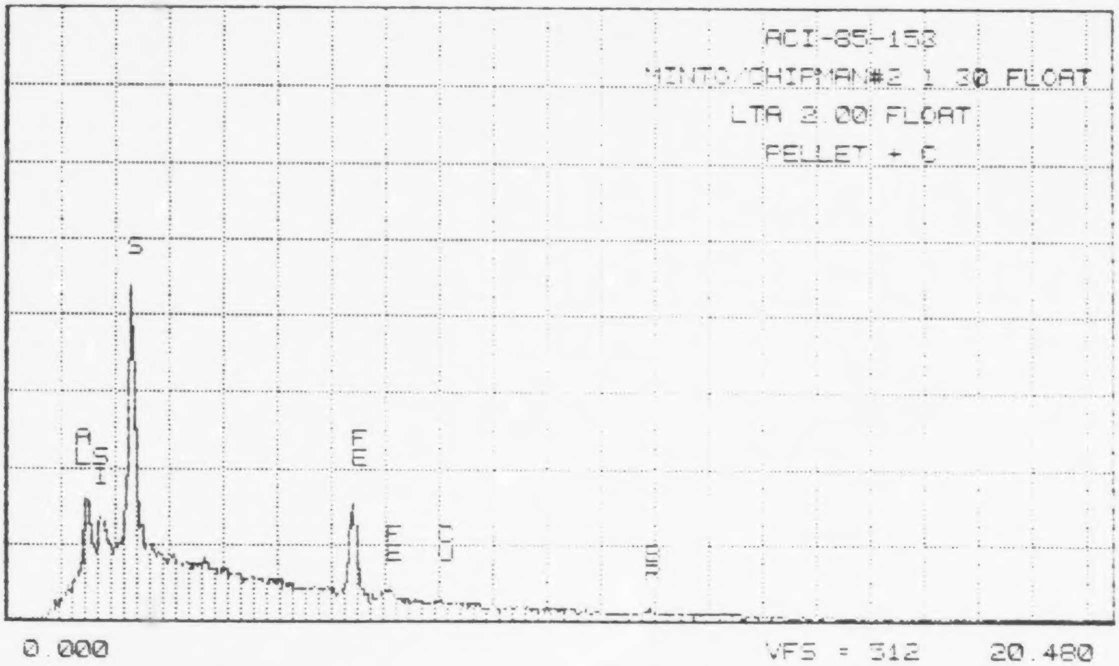


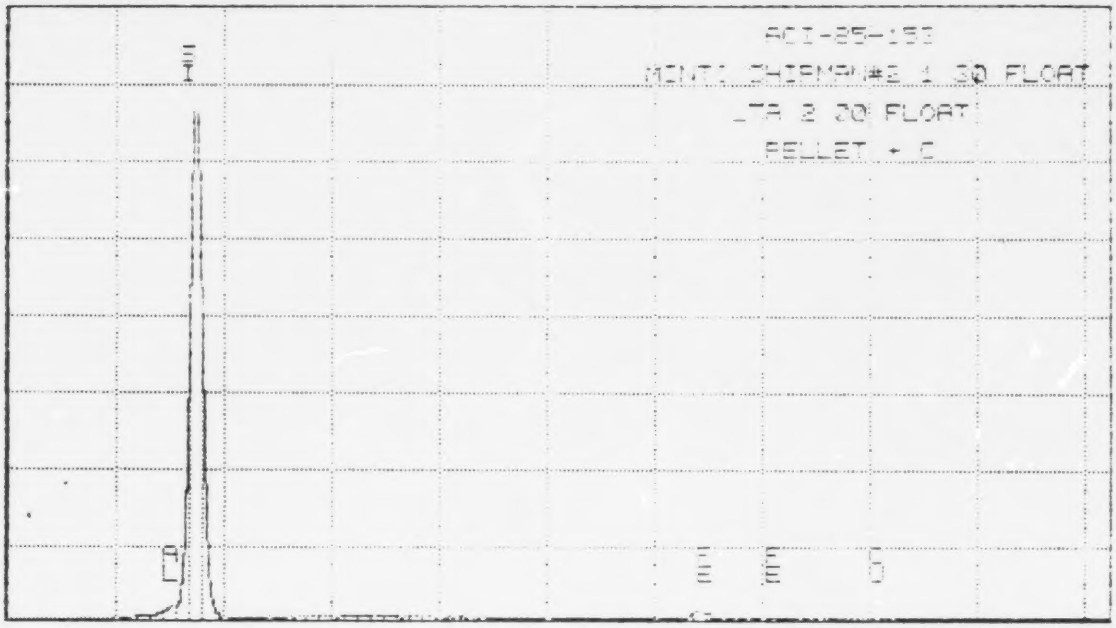
ACI-85-153
MINTO/CHIPMAN#2 1 30 FLOAT
LTA 2.00 FLOAT
PELLET + C

18

MATRIX: PHOTO#1128-05.EDX4 50

ATLANTIC COAL INSTITUTE　　　　MON 01-DEC-86　08:33

Cursor: 0.000keV = 0

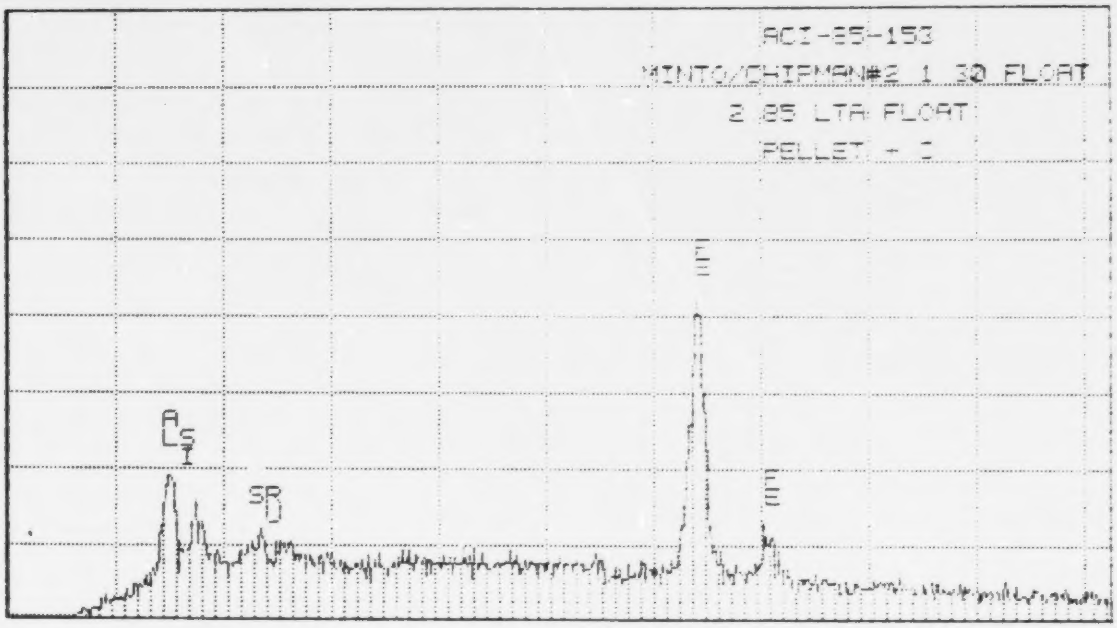


19

0.000　　　　VFS = 8192　　10.240

50　　MINERAL **Q**　　PHOTO=1128-05.EDX5

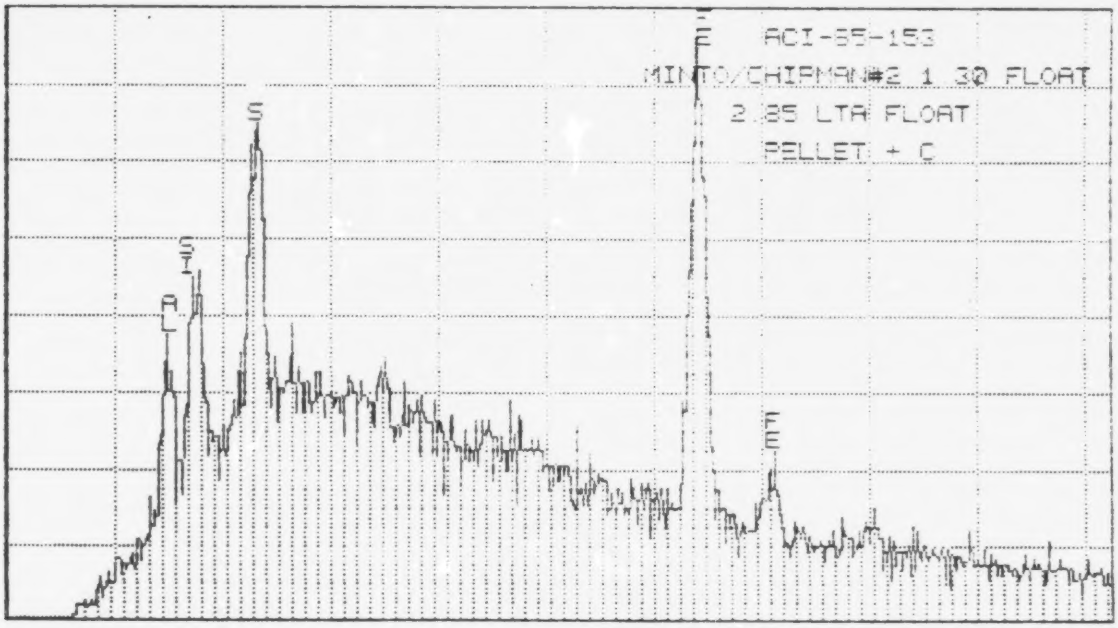
ATLANTIC COAL INSTITUTE MON 01-DEC-86 11:58
Cursor: 0.000keV = 0



20

0.000 VFS = 256 10.240
50 CONTAMINANT: PHOTO#1128-06.EDX1

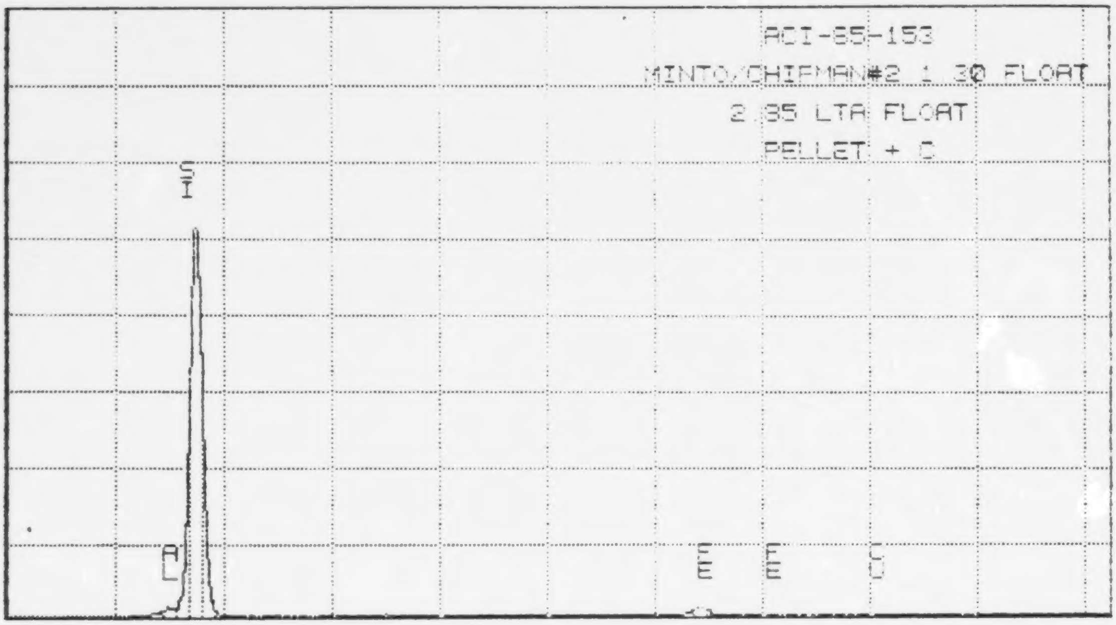
ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:00
Cursor: 0.000keV = 0



21

0.000 VFS = 128 10.240
50 MATRIX: PHOTO#1128-06.EDX2

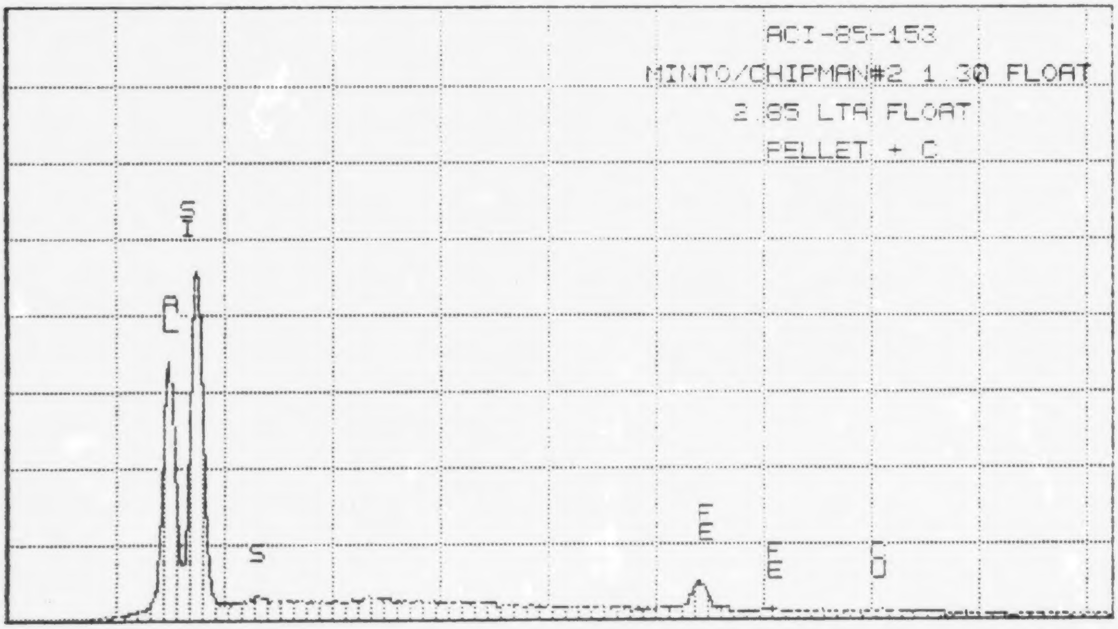
ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:02
Cursor: 0.000keV = 0



22

0.000 VFS = 8192 10.240
50 MINERAL: **Q** PHOTO#1128-06.EDX3

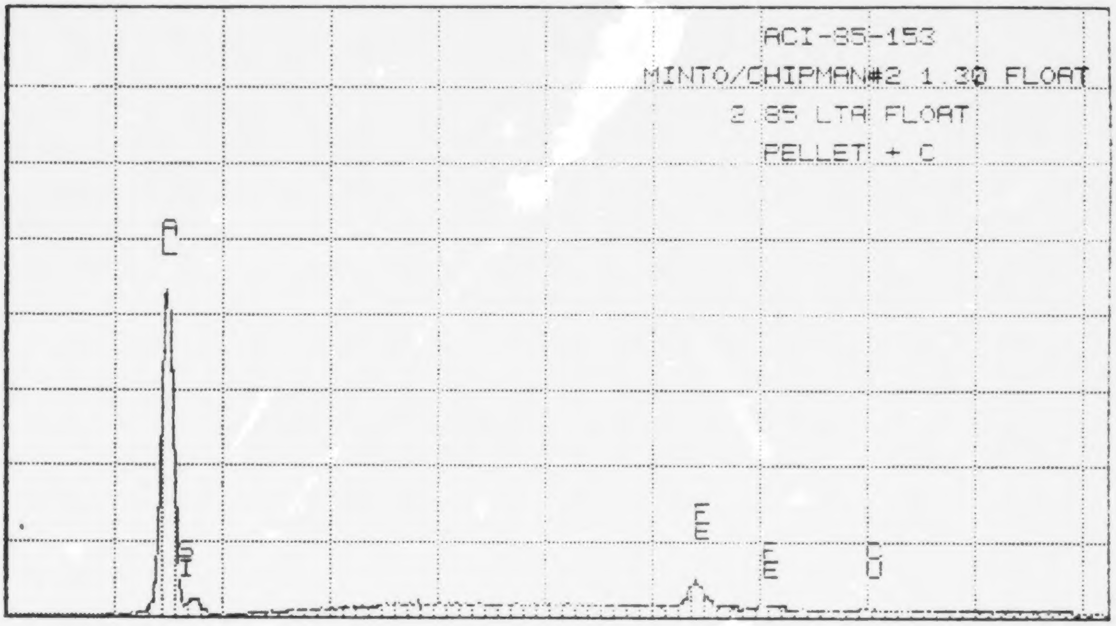
ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:04
Cursor: 0.000keV = 0



23

0.000 VFS = 2048 10.240
50 MINERAL: **K** PHOTO#1128-06.EDX4

ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:06
Cursor: 0.000keV = 0

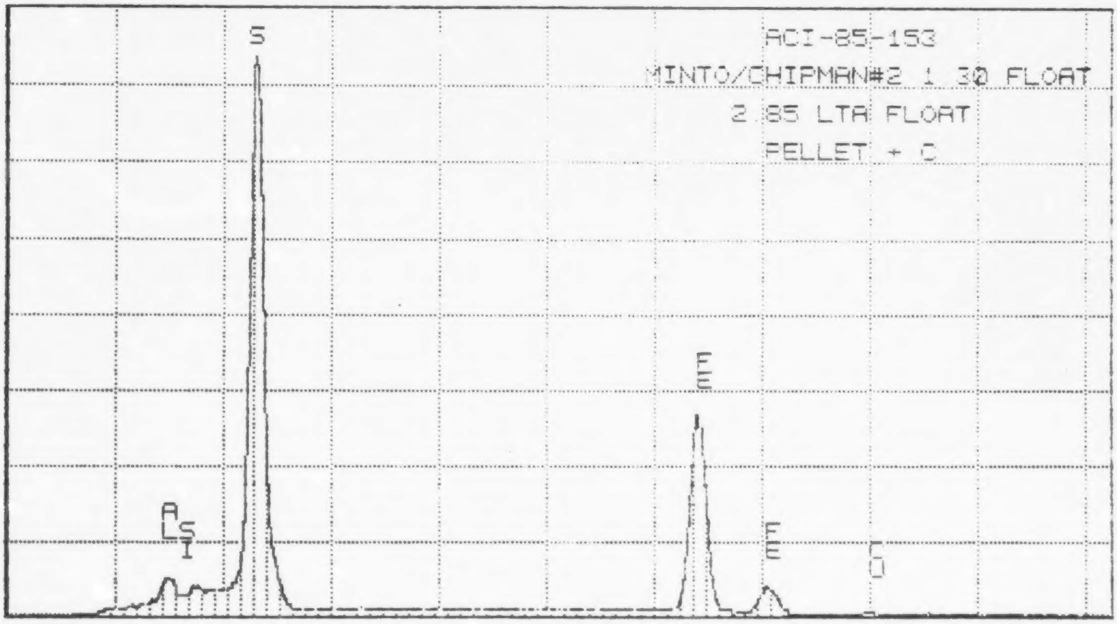


ACI-85-153
MINTO/CHIPMAN#2 1.30 FLOAT
2.85 LTA FLOAT
PELLET + C

24

0.000 VFS = 2048 10.240
50 MINERAL: PHOTO#1128-06.EDX5

ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:08
Cursor: 0.000keV = 0

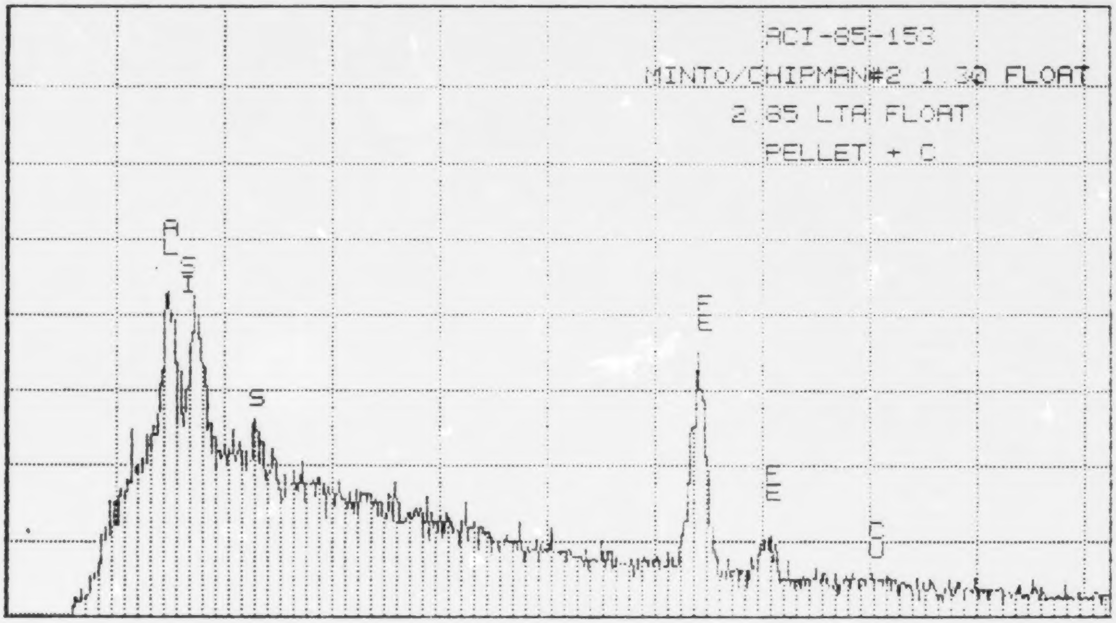


ACI-85-153
MINTO/CHIPMAN#2 1.30 FLOAT
2.85 LTA FLOAT
PELLET + C

25

0.000 VFS = 8192 10.240
50 MINERAL: P PHOTO#1128-06.EDX6

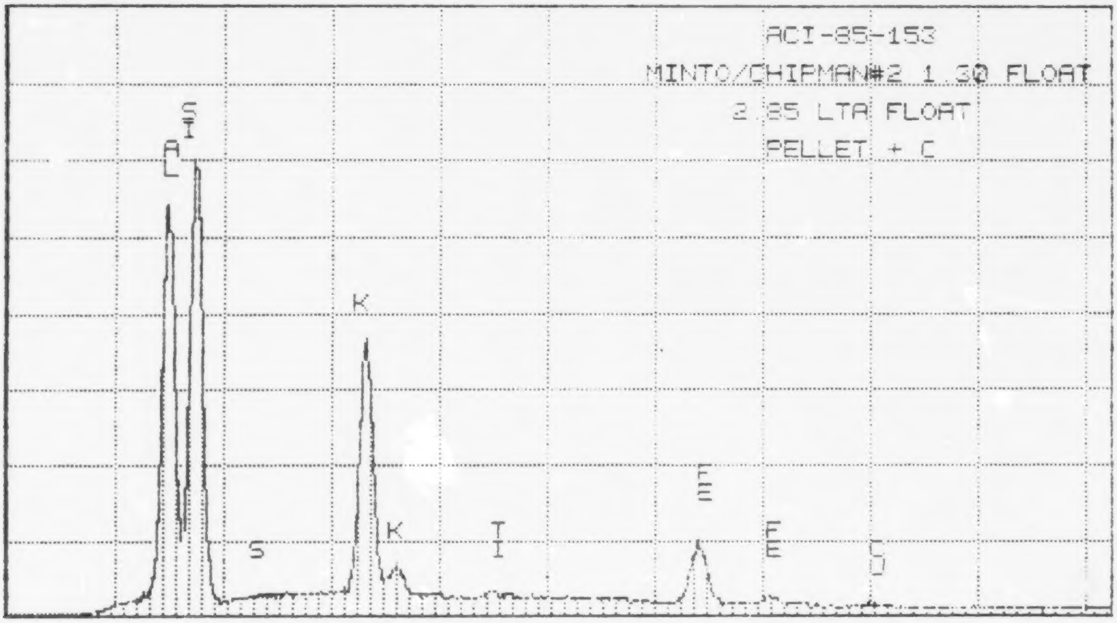
ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:11
Cursor: 0.000keV = 0



26

0.000 VFS = 256 10.240
50 MATRIX: PHOTO#1128-06.EDX7

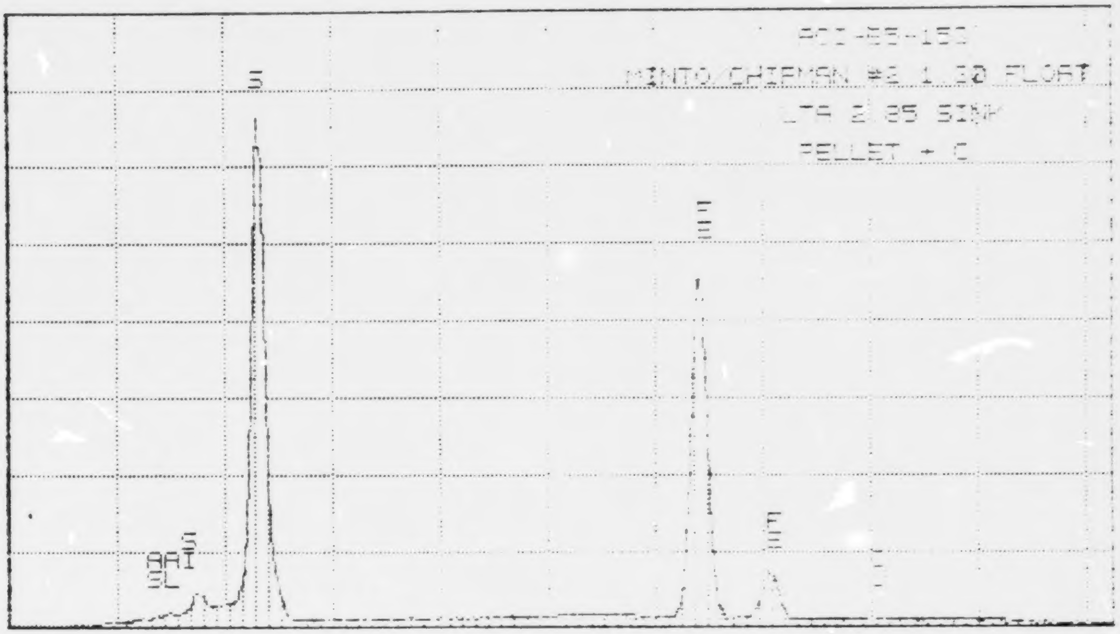
ATLANTIC COAL INSTITUTE MON 01-DEC-86 12:13
Cursor: 0.000keV = 0



27

0.000 VFS = 2048 10.240
50 MINERAL: I + Ti PHOTO#1128-06.EDX8

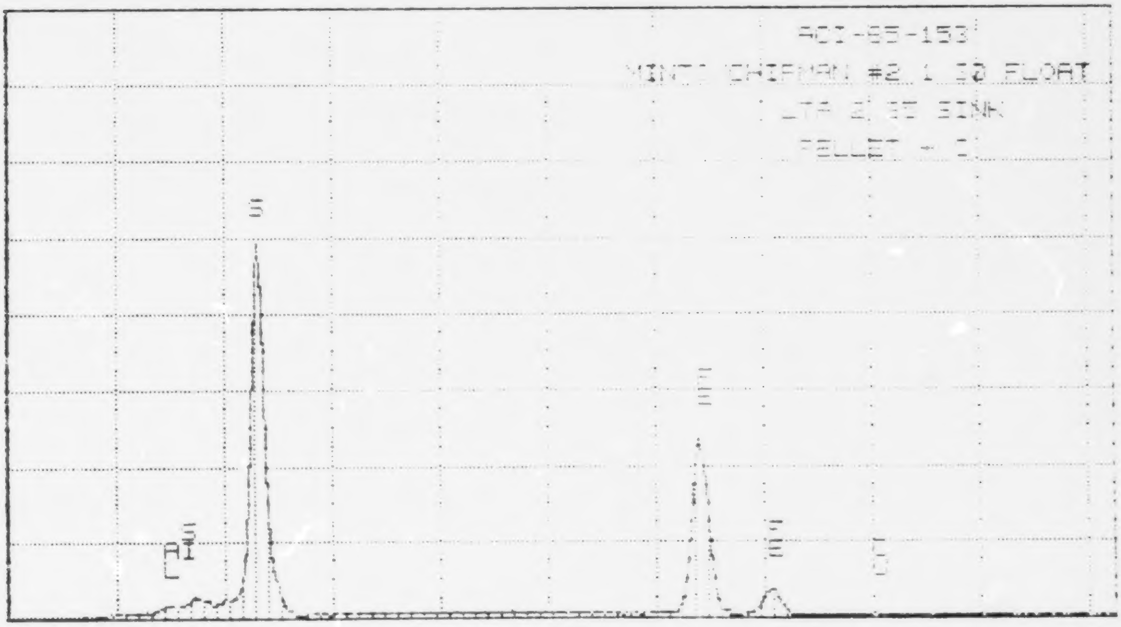
ATLANTIC COAL INSTITUTE MON 01-DEC-86 15:58
Cursor: 0.000keV = 0



28

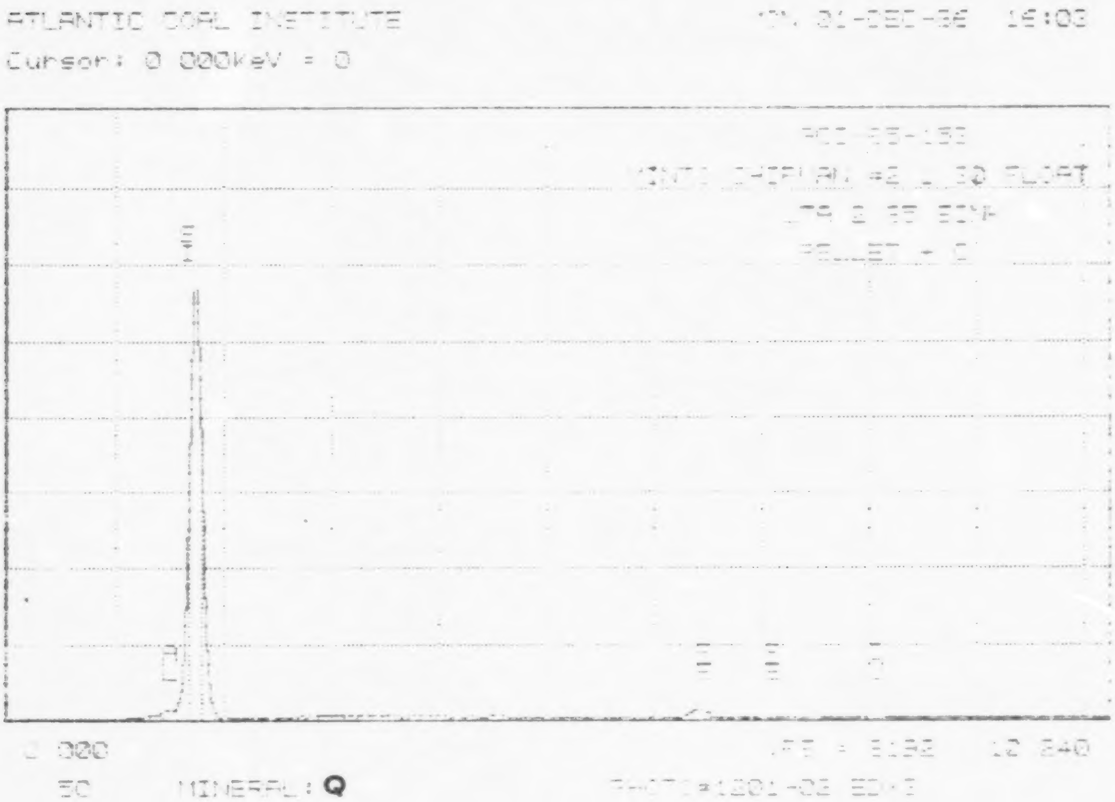
0.000 VFS = 4096 10.240
50 MINERAL: **P** PHOTO#1201-02.EDX1

ATLANTIC COAL INSTITUTE MON 01-DEC-86 16:01
Cursor: 0.000keV = 0

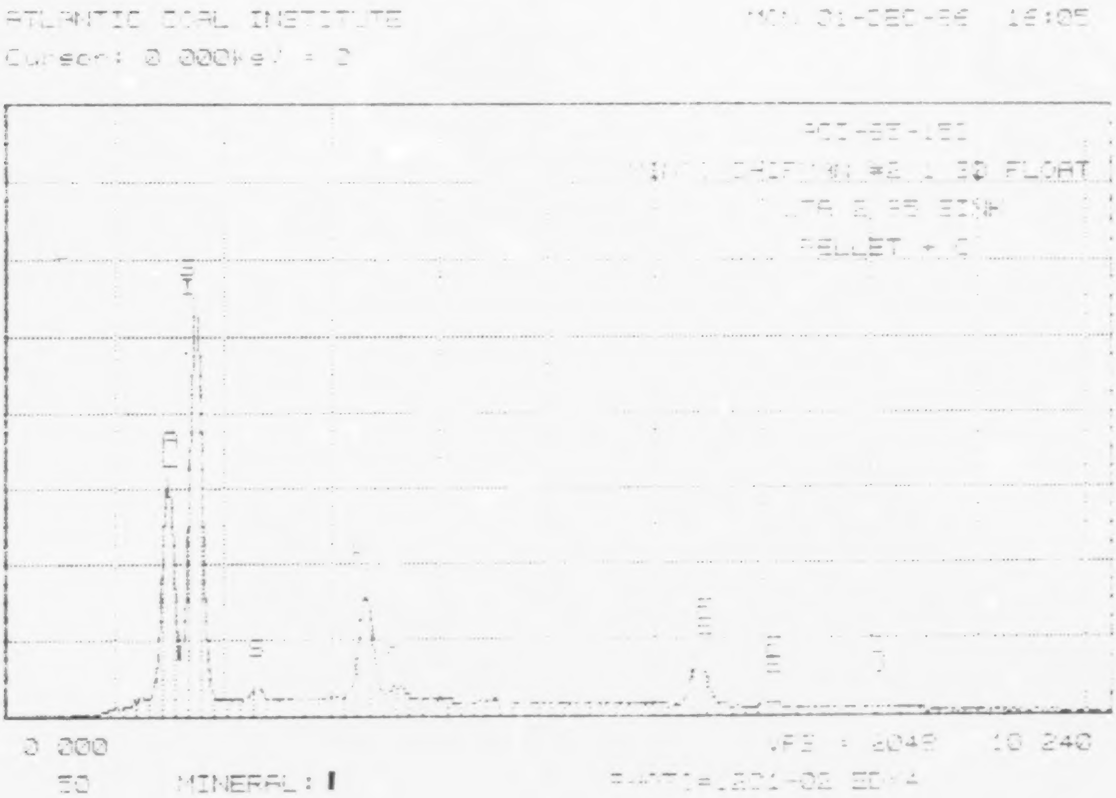


29

0.000 VFS = 3132 10.240
50 MINERAL: **P** PHOTO#1201-02.EDX2


ATLANTIC COAL INSTITUTE
MON 01-DEC-86 16:03
Cursor: 0.000keV = 0
ACI-86-150
MINTO CHIPMAN #2 1.30 FLOAT
LTA 2.85 SINK
PELLET + C
0.000
VFS = 8192
10.240
50
MINERAL: Q
PHOTO#1201-02 EDXI

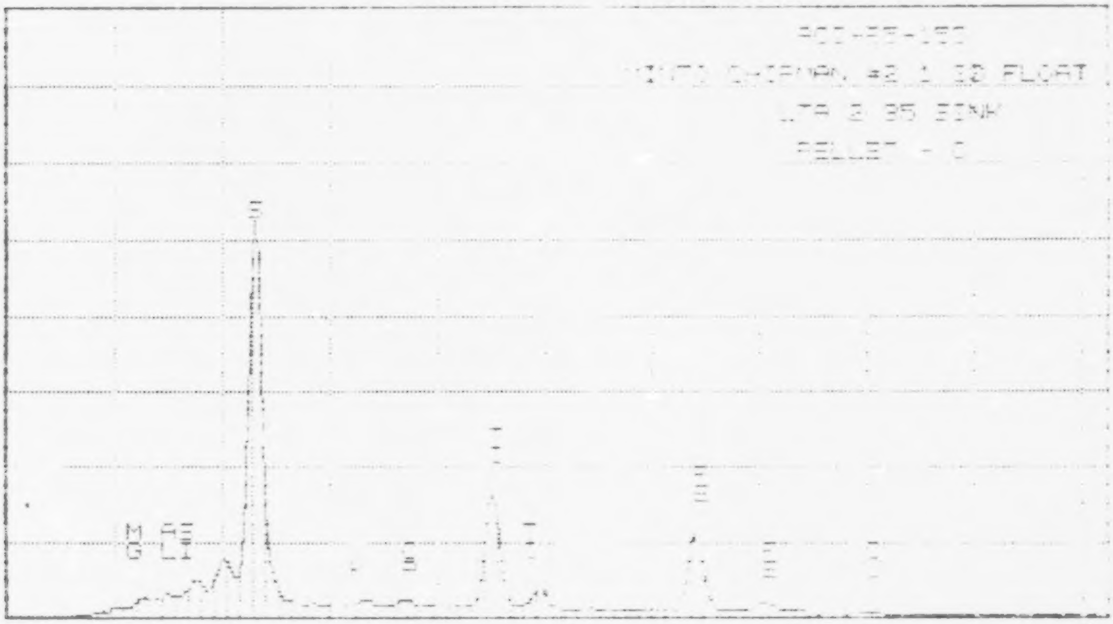
30


ATLANTIC COAL INSTITUTE
MON 01-DEC-86 16:05
Cursor: 0.000keV = 0
ACI-86-150
MINTO CHIPMAN #2 1.30 FLOAT
LTA 2.85 SINK
PELLET + C
0.000
VFS = 2048
10.240
50
MINERAL: I
PHOTO#1201-02 EDX4

31

ATLANTIC COAL INSTITUTE MON 01-DEC-86 16:07

Cursor: 0.000keV = 0



ACI-86-150

MINTO CHIPMAN, #2 1.30 FLOAT

LTA 2.35 SINK

PELLET - C

32

0.200 VFS = 4096 10.240

50 MINERAL: PHOTO#1201-02 ED 5

PLATE 15

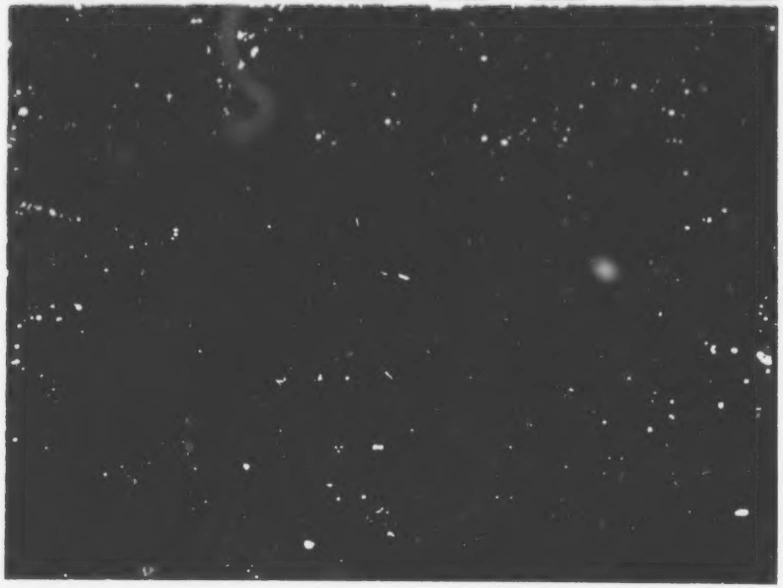
MINERAL ANALYSIS

Minto/Chipman #2, -42 mesh to +100 mesh sieve fraction; 1.50 sink;
Low Temperature Ashed; float-sunk:
2.00 float; 2.85 float, 2.85 sink

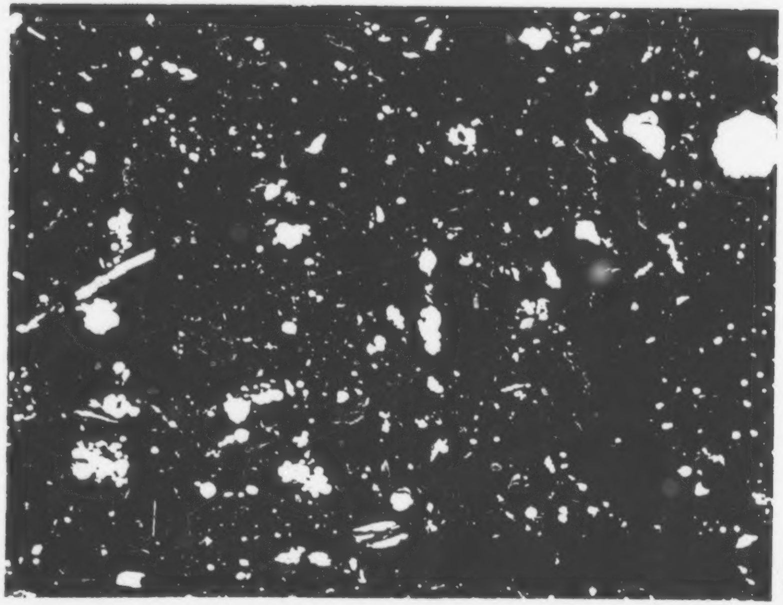
Photo No.	Index No.	Description	Spectra No.
1	1128-01	Original LTA; 100x; BEI	1,2,3,4,5,6,7
2	1128-02	2.85 float; 100x; BEI	8,9,10,11
3	1128-03	2.85 sink; 100x; BEI	12,13,14,15,16,17

Note: No sample for 2.00 float

1



2



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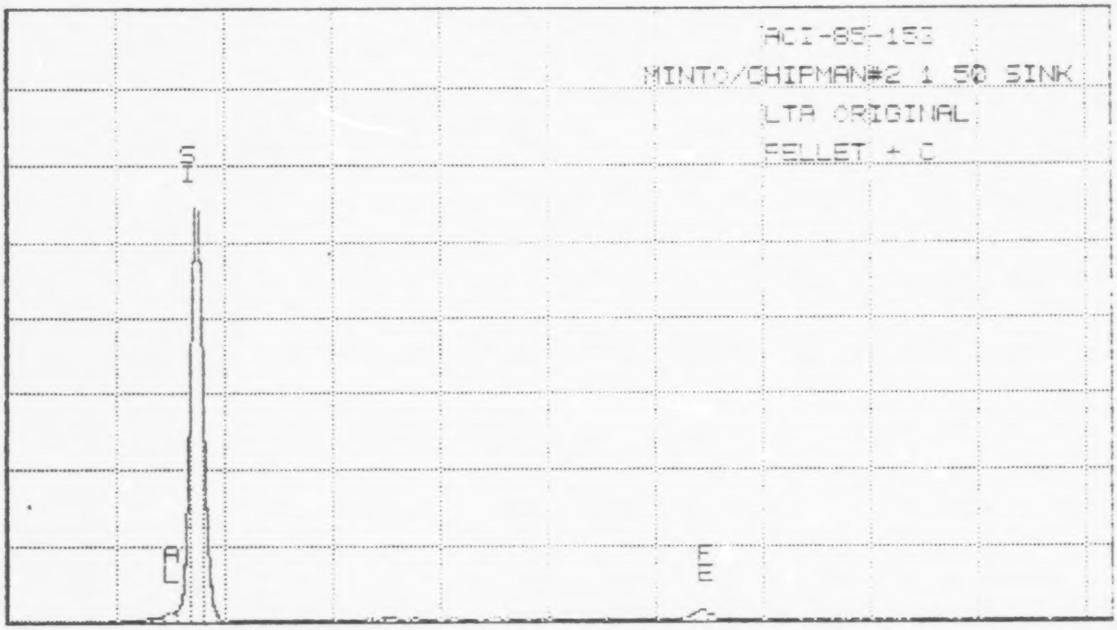
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:00

Cursor: 0.000keV = 0



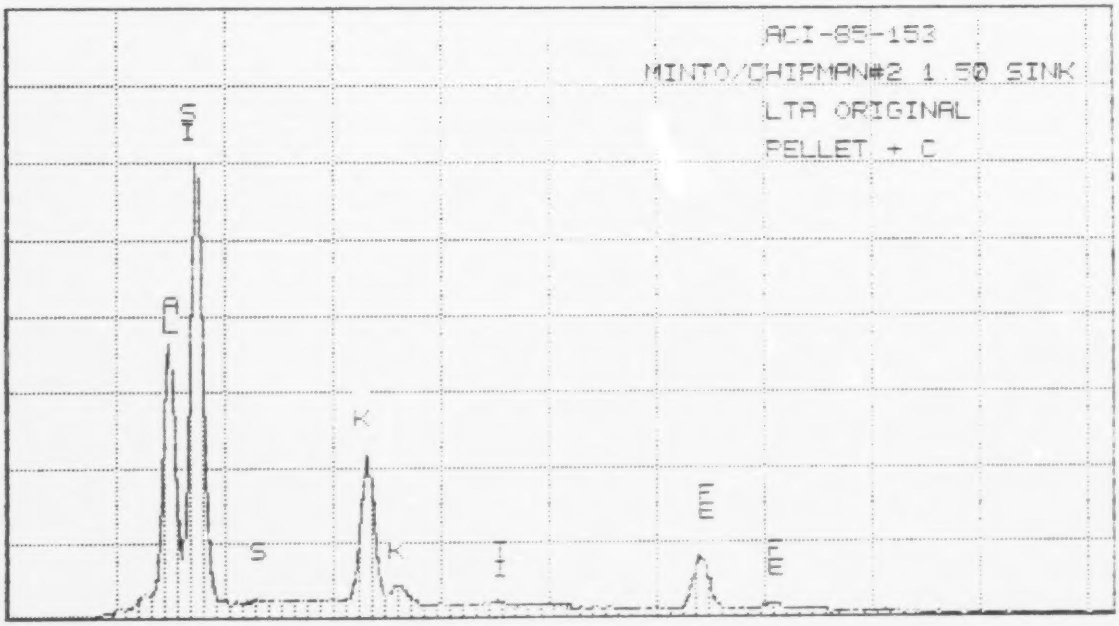
1

0.000 VFS = 8192 10.240

50 MINERAL: **Q** PHOTO#1128-01.EDX1

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:02

Cursor: 0.000keV = 0

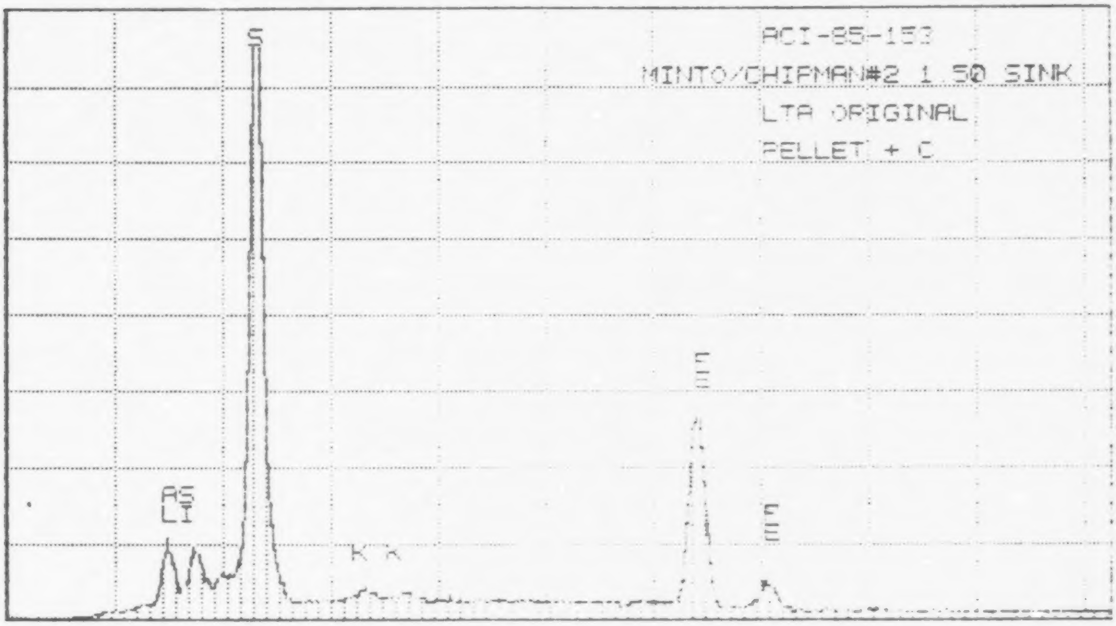


2

0.000 VFS = 4096 10.240

50 MINERAL: **I** PHOTO#1128-01.EDX2

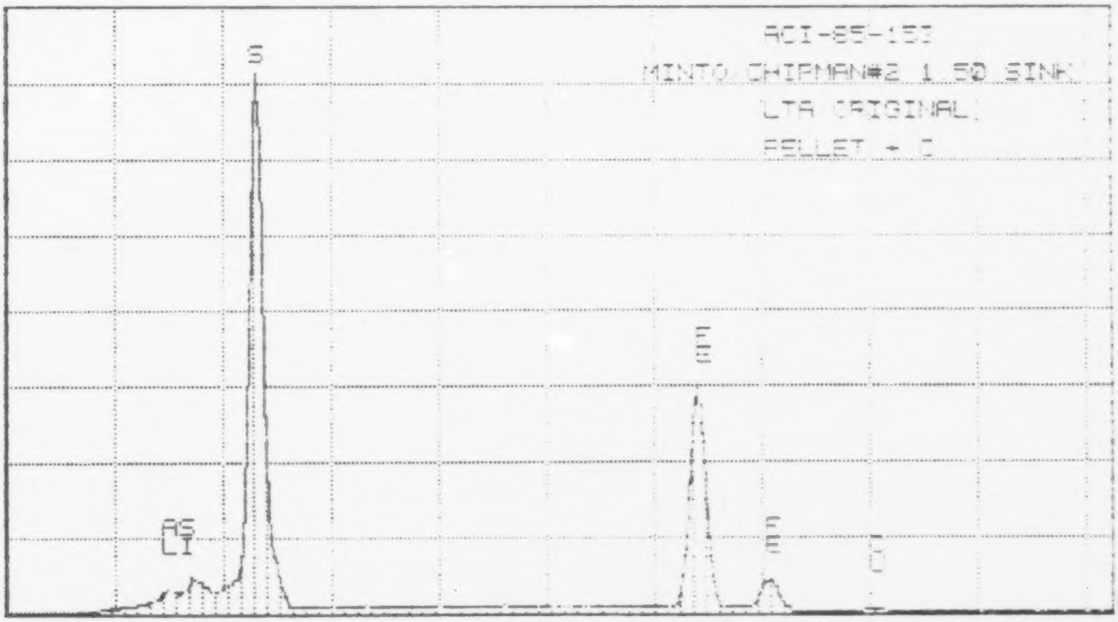
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:04
Cursor: 0.000keV = 0



3

0.000 VFS = 2048 10.240
50 MINERAL:**P** PHOTO#1128-01 EDX3

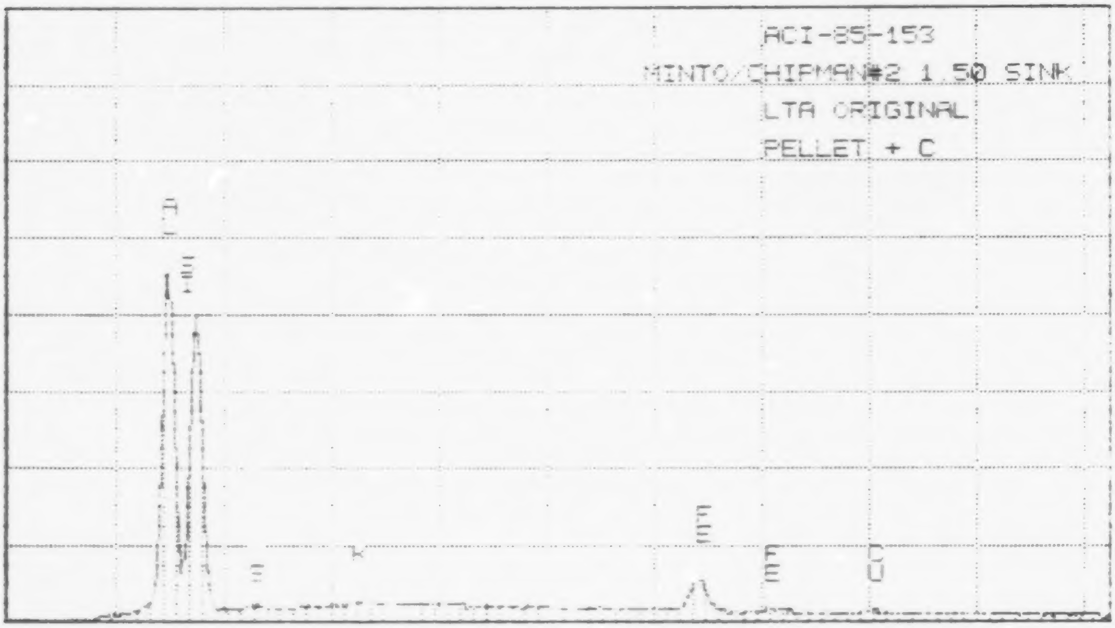
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:06
Cursor: 0.000keV = 0



4

0.000 VFS = 8192 10.240
50 MINERAL:**P** PHOTO#1128-01.EDX4

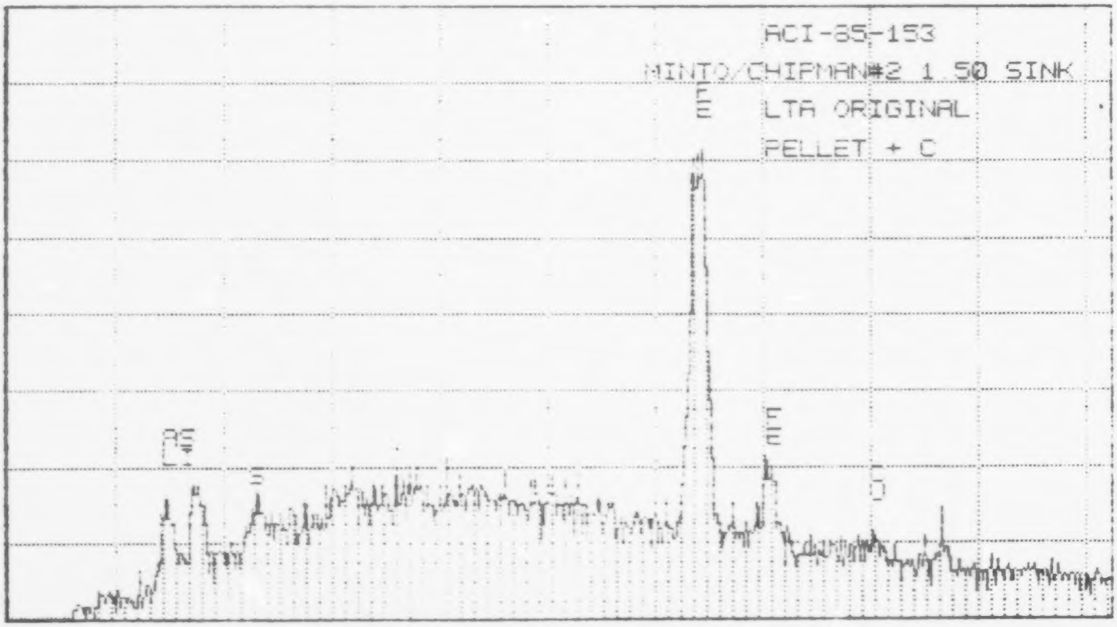
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:08
Cursor: 0 000keV = 0



5

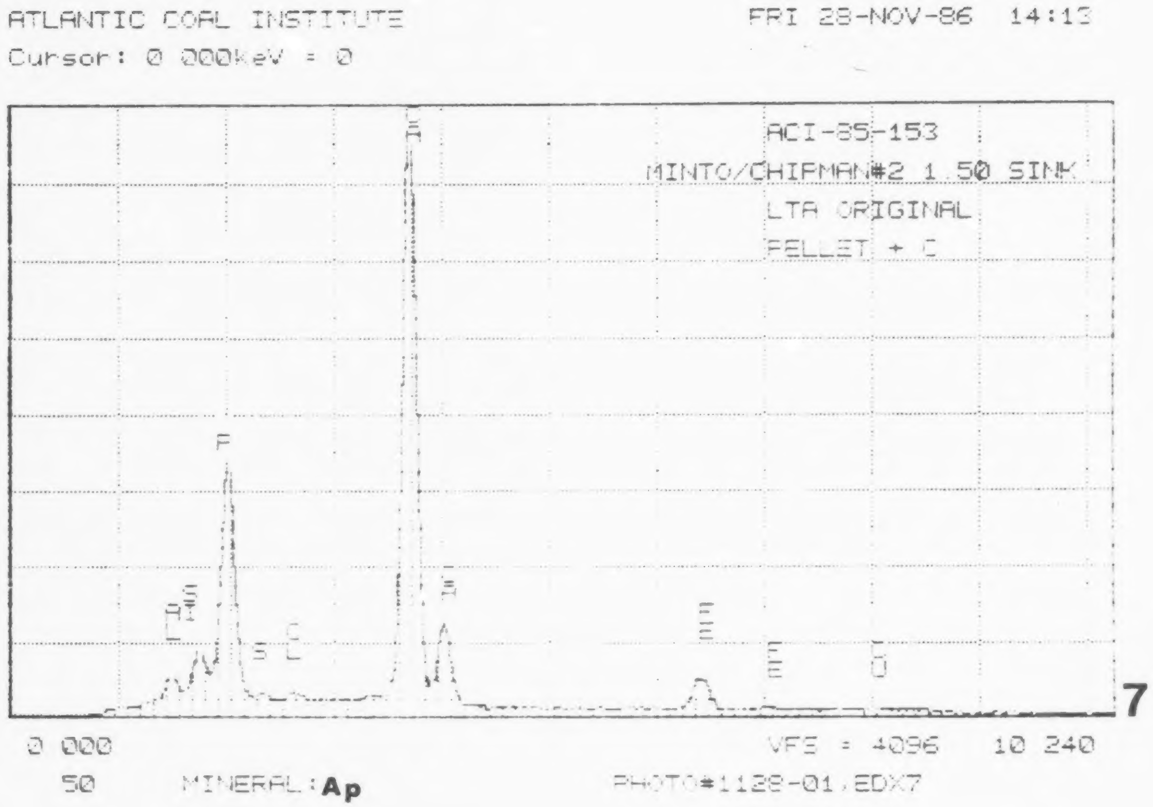
0.000 VFS = 2048 10.240
50 MINERAL: **K** PHOTO#1128-01.EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:11
Cursor: 0 000keV = 0



6

0 000 VFS = 128 10 240
50 MATRIX: PHOTO#1128-01.EDX6



ATLANTIC COAL INSTITUTE FRI 28-NOV-86 14:13

Cursor: 0.000keV = 0

ACI-85-153

MINTO/CHIPMAN#2 1.50 SINK

LTA ORIGINAL

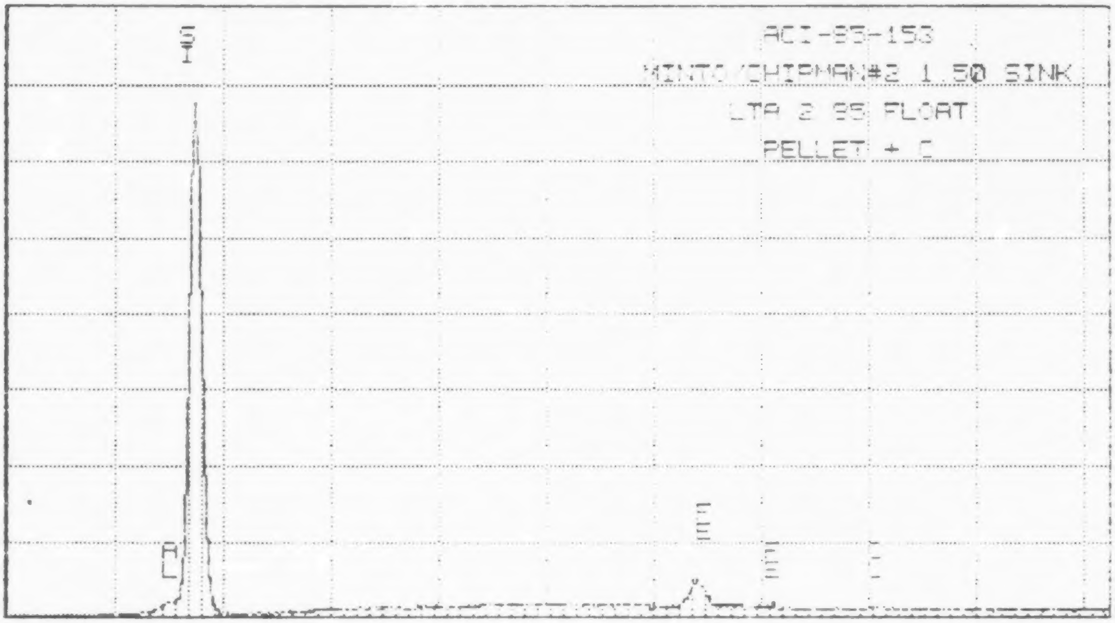
PELLET + C

0.000 VFS = 4096 10.240

50 MINERAL: **Ap** PHOTO#1128-01.EDX7

7

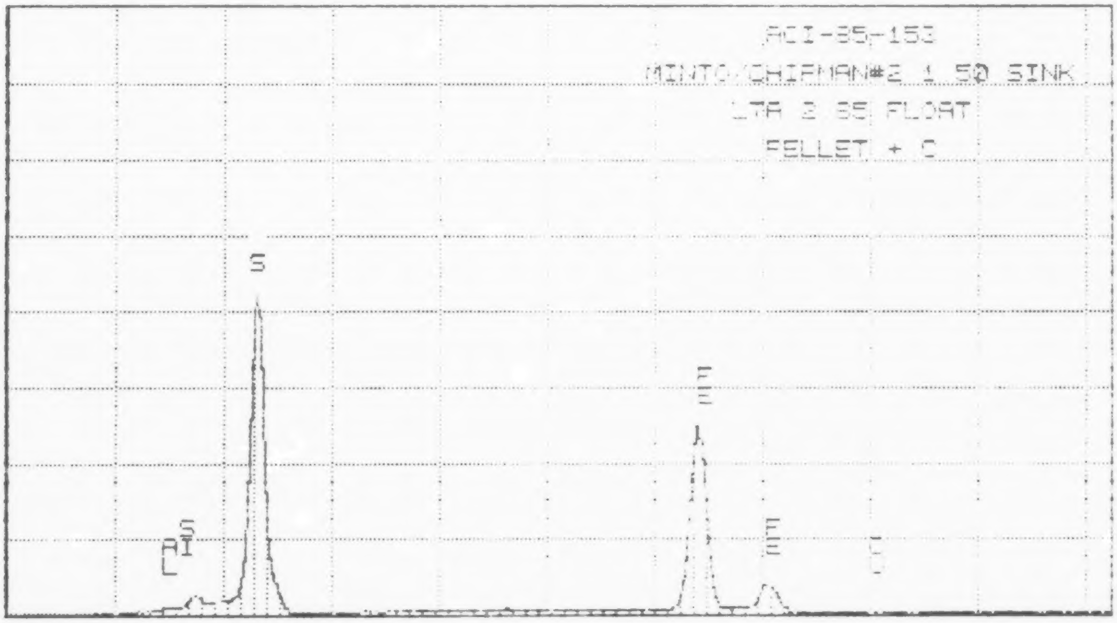
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:12
Cursor: 0.000keV = 0



8

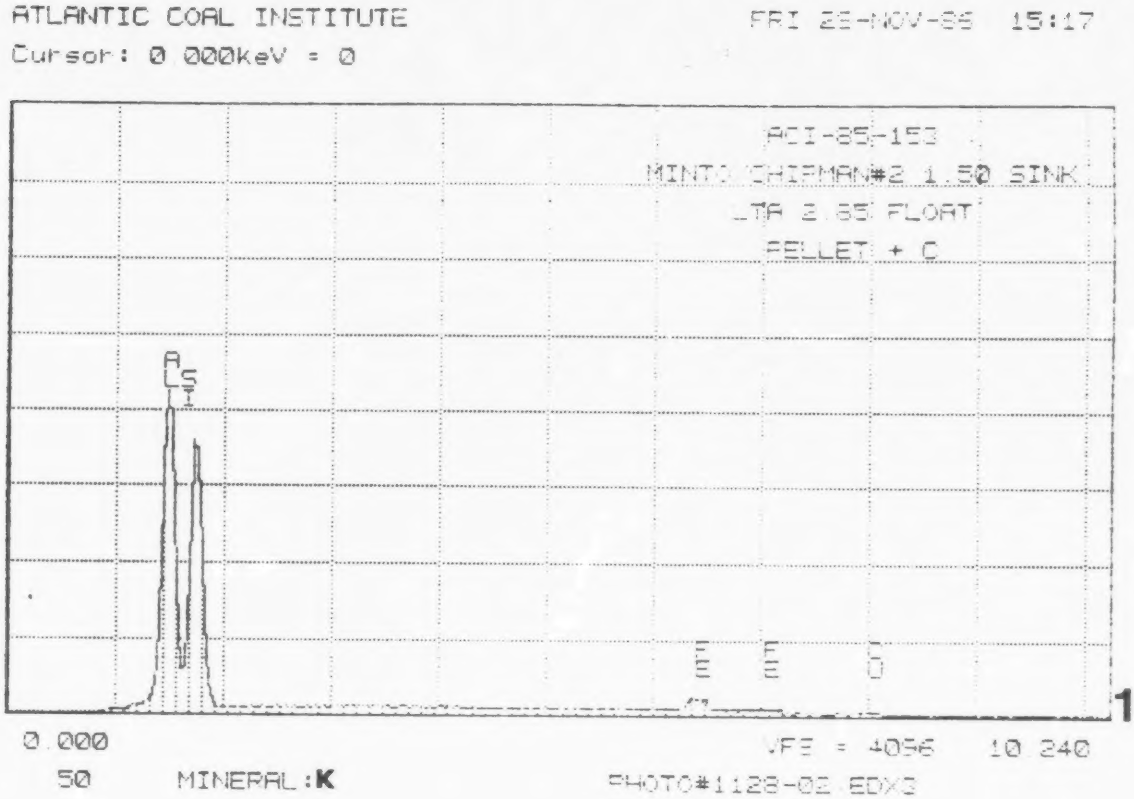
0.000 VFS = 2048 10.240
50 MINERAL:**Q** PHOTO#1128-02.EDX1

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:14
Cursor: 0.000keV = 0



9

0.000 VFS = 8192 10.240
50 MINERAL:**P** PHOTO#1128-02.EDX2



ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:17

Cursor: 0.000keV = 0

ACI-85-153

MINTO/CHIPMAN#2 1.50 SINK

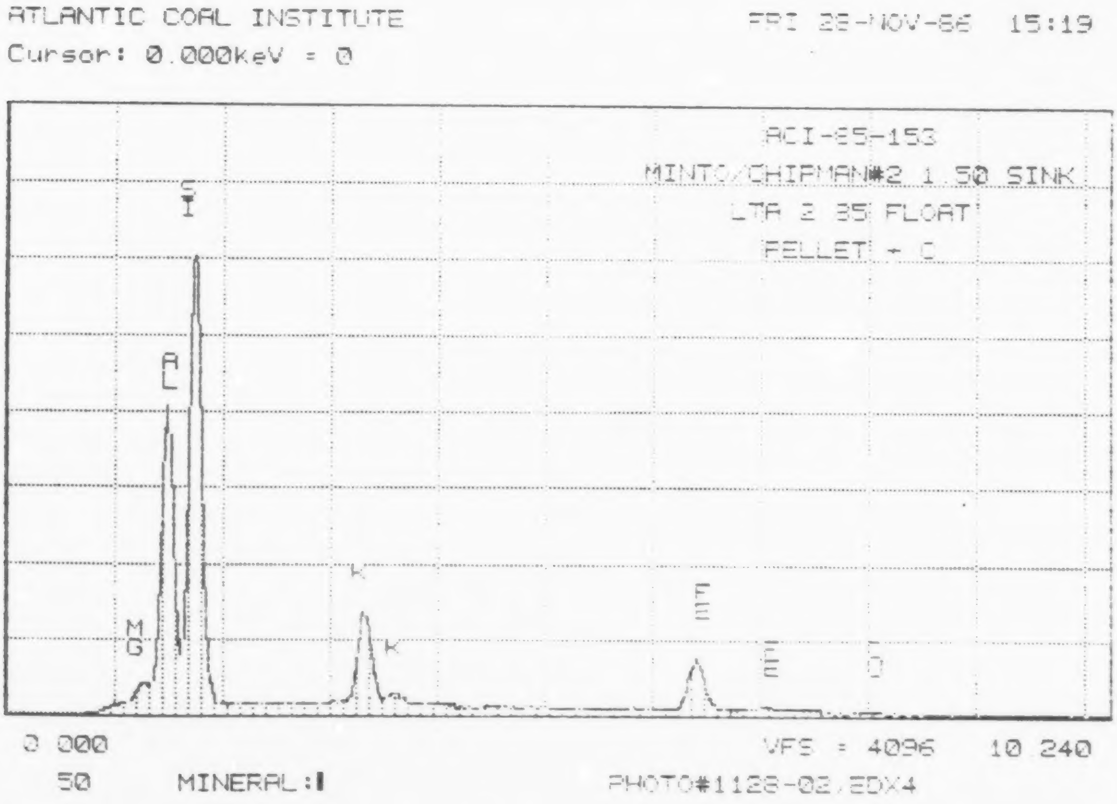
LTA 2.85 FLOAT

PELLET + C

0.000 VFS = 4096 10.240

50 MINERAL:**K** PHOTO#1128-02.EDX3

10



ATLANTIC COAL INSTITUTE FRI 28-NOV-86 15:19

Cursor: 0.000keV = 0

ACI-85-153

MINTO/CHIPMAN#2 1.50 SINK

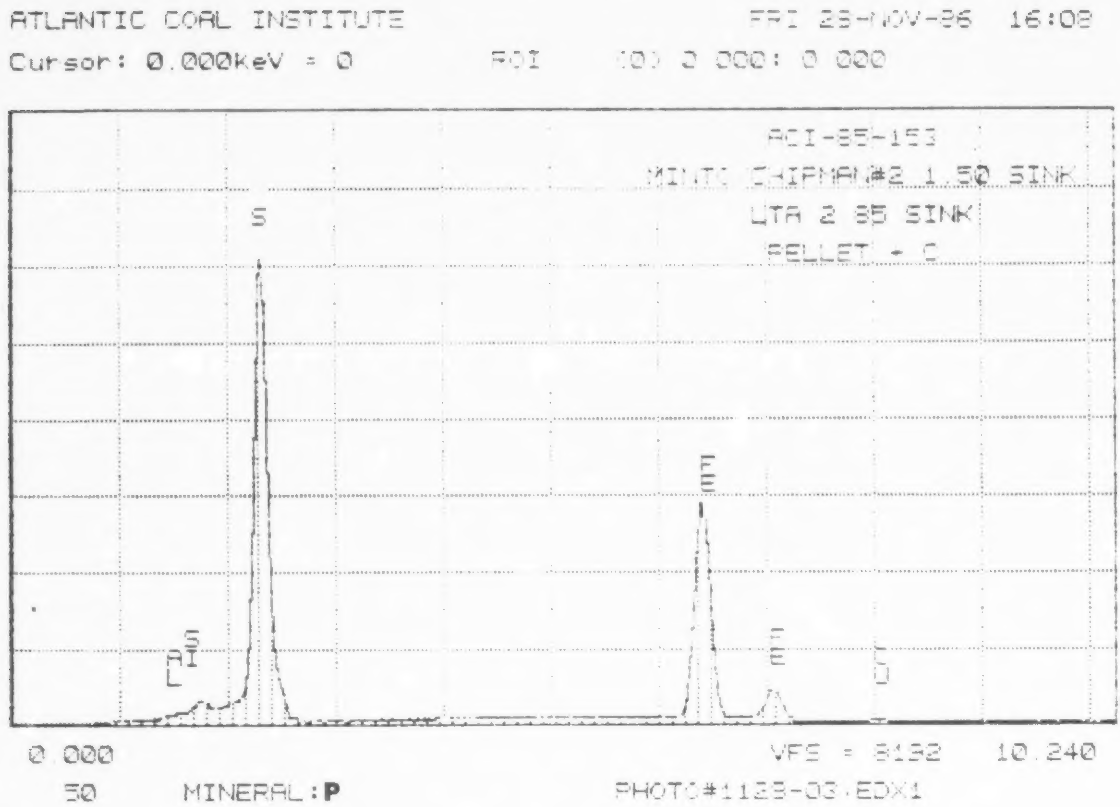
LTA 2.85 FLOAT

PELLET + C

0.000 VFS = 4096 10.240

50 MINERAL:**I** PHOTO#1128-02.EDX4

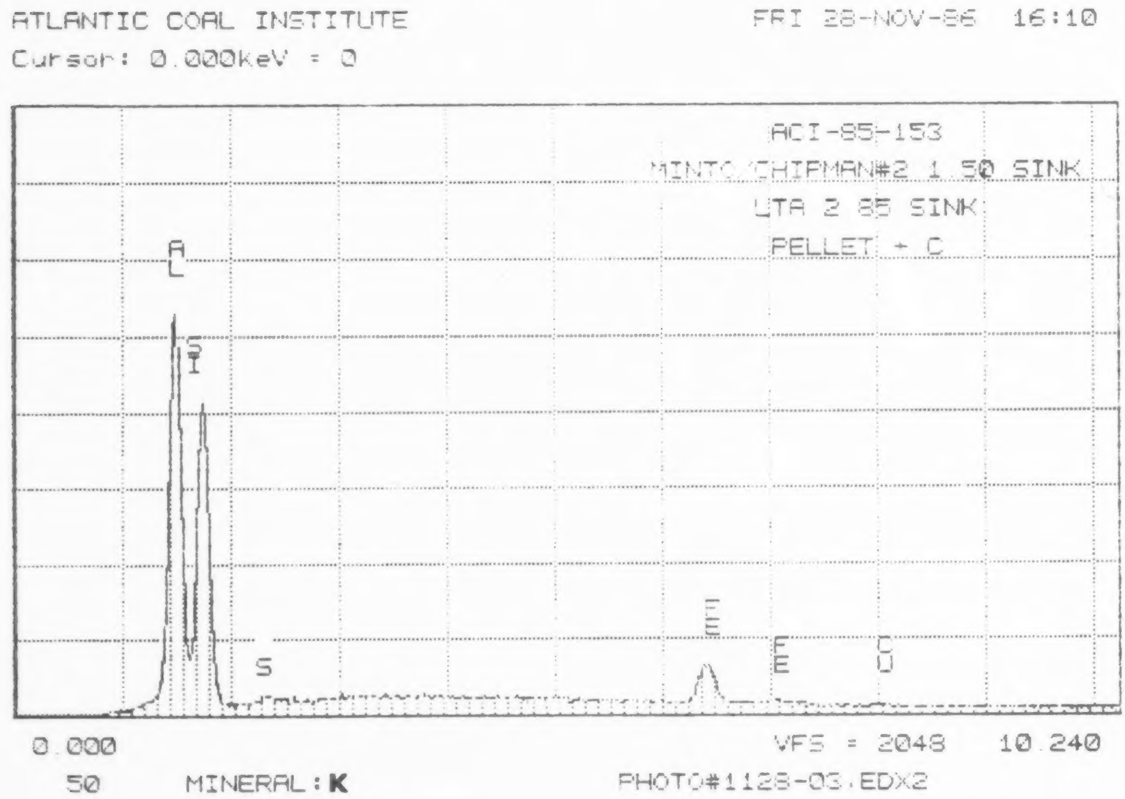
11



```
ATLANTIC COAL INSTITUTE                         FRI 28-NOV-86  16:08
Cursor: 0.000keV = 0          ROI    (0) 0.000: 0.000
```

```
  0.000                                          VFS = 8192    10.240
   50       MINERAL:P                    PHOTO#1128-03.EDX1
```

12



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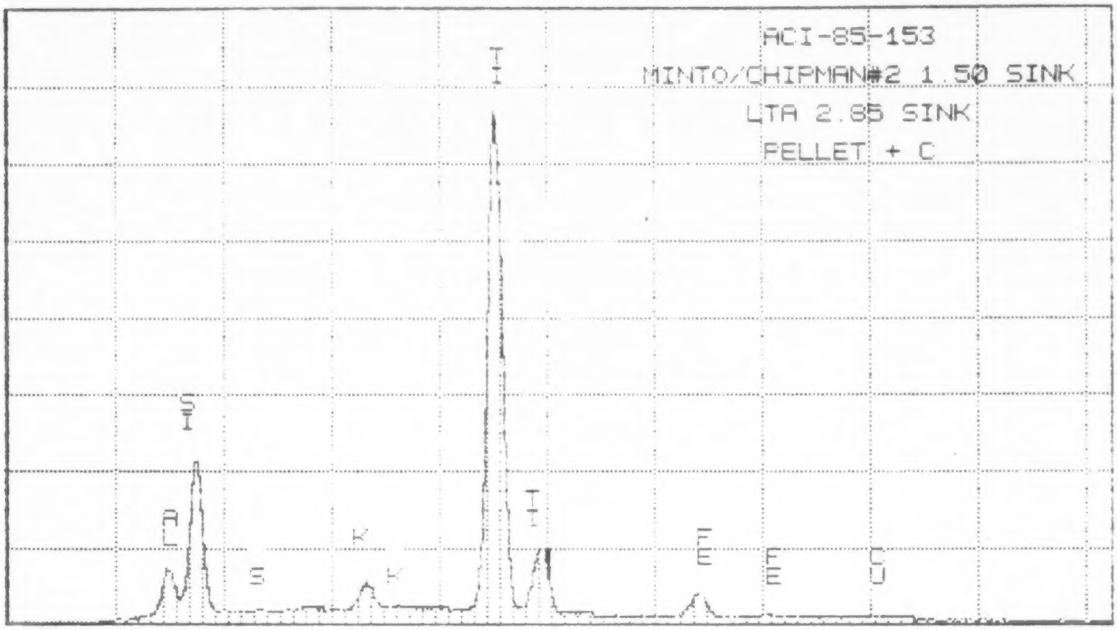
ATLANTIC COAL INSTITUTE                         FRI 28-NOV-86  16:10
Cursor: 0.000keV = 0
```

```
  0.000                                          VFS = 2048    10.240
   50       MINERAL:K                    PHOTO#1128-03.EDX2
```

13

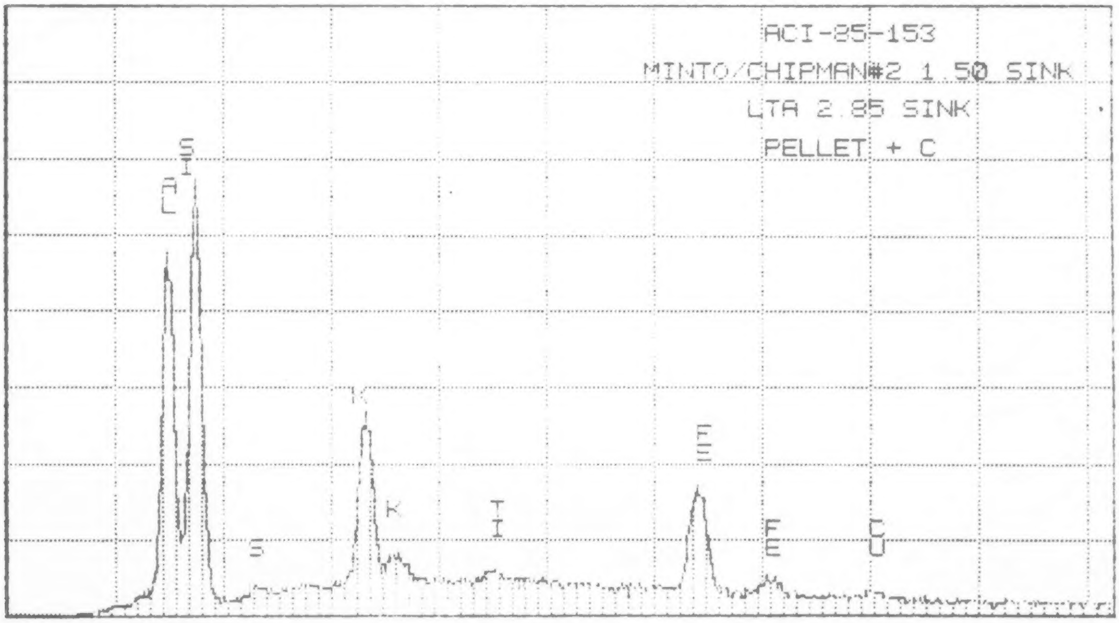
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:12
Cursor: 0.000keV = 0



14

0.000 VFS = 4096 10.240
50 MINERAL: **R** PHOTO#1128-03.EDX3

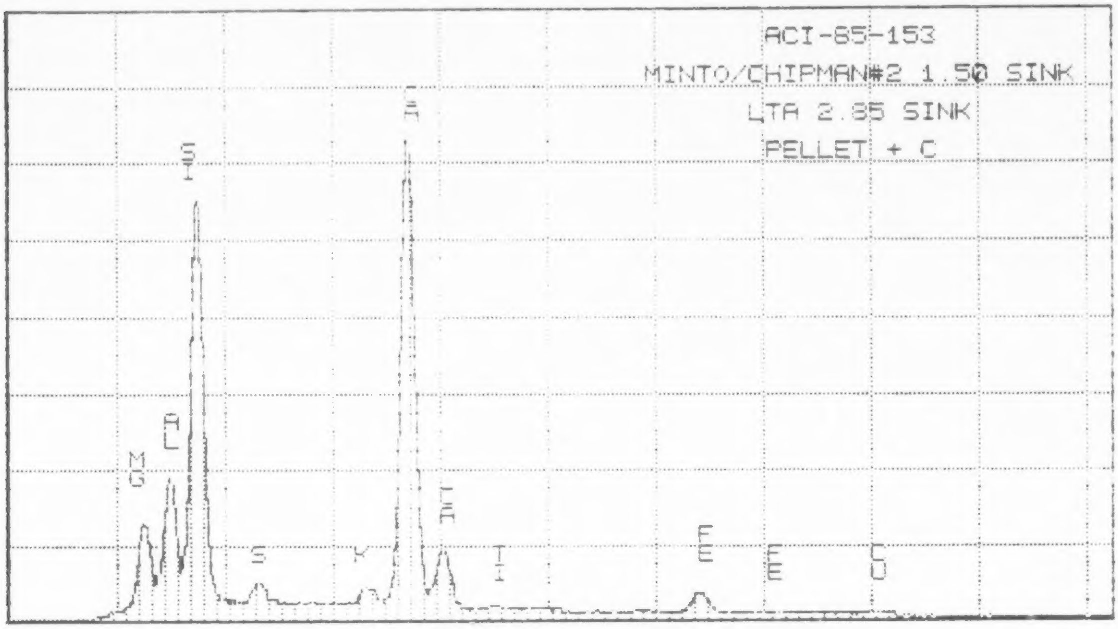
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:14
Cursor: 0.000keV = 0



15

0.000 VFS = 1024 10.240
50 MINERAL: **I +TI** PHOTO#1128-03.EDX4

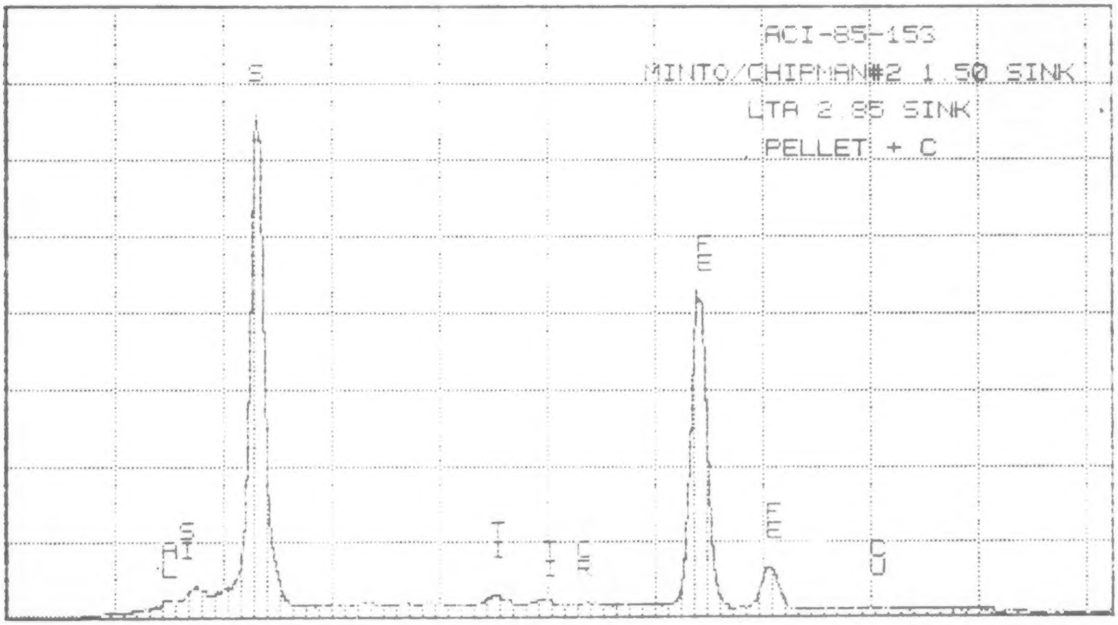
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:17
Cursor: 0.000keV = 0



16

0.000 VFS = 4096 10.240
50 MINERAL: PHOTO#1128-03.EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 16:19
Cursor: 0.000keV = 0



17

0.000 VFS = 4096 10.240
50 MINERAL: **P** PHOTO#1128-03.EDX6

PLATE 16

MINERAL ANALYSIS
Minto/Chipman #2, -42 mesh to +100 mesh sieve fraction; 1.80 sink;
Low Temperature Ashed; float-sunk:
2.00 float; 2.85 float, 2.85 sink

Photo No.	Index No.	Description	Spectra No.
1	1126-09	Original LTA; 100x; BEI	1,2,3,4,5,6,7,8,9,10,11
2	1127-02	2.00 float; 100x; SEI	
3	1127-03	Same view as P#2; BEI	12,13,14,15,16,17,18,19,20
4	1127-09	2.85 float, 100x; BEI	21,22,23,24,25,26,27,28,29
5	1127-10	2.85 sink; 100x; BEI	30,31,32,33,34,35

1

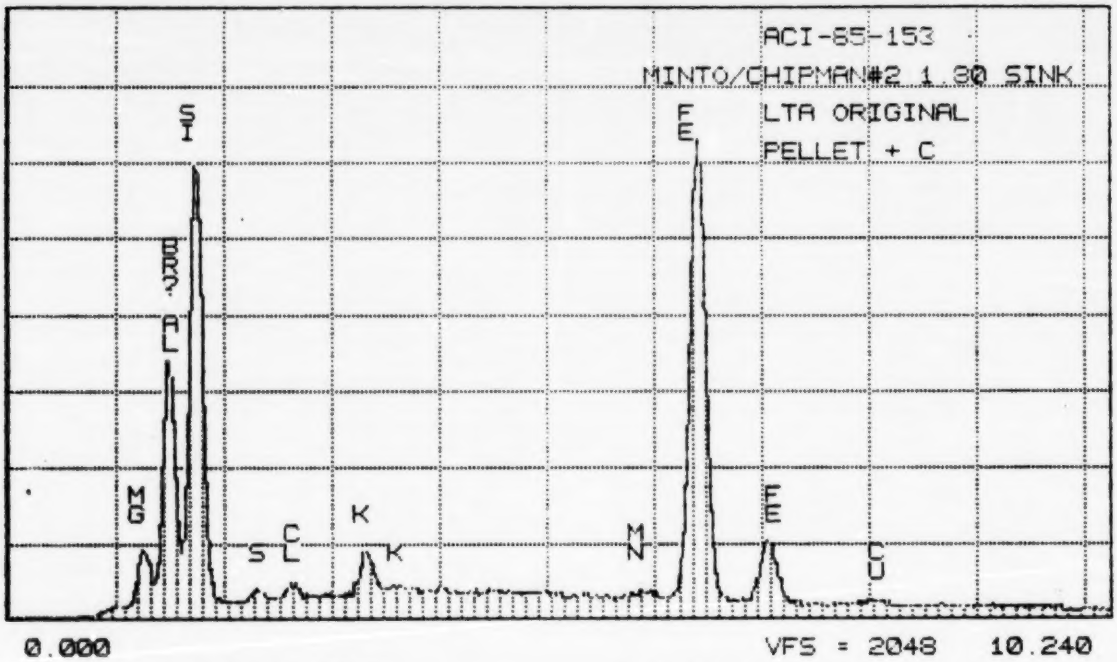
2

3

4

5

ATLANTIC COAL INSTITUTE THU 27-NOV-86 10:09
Cursor: 0.000keV = 0

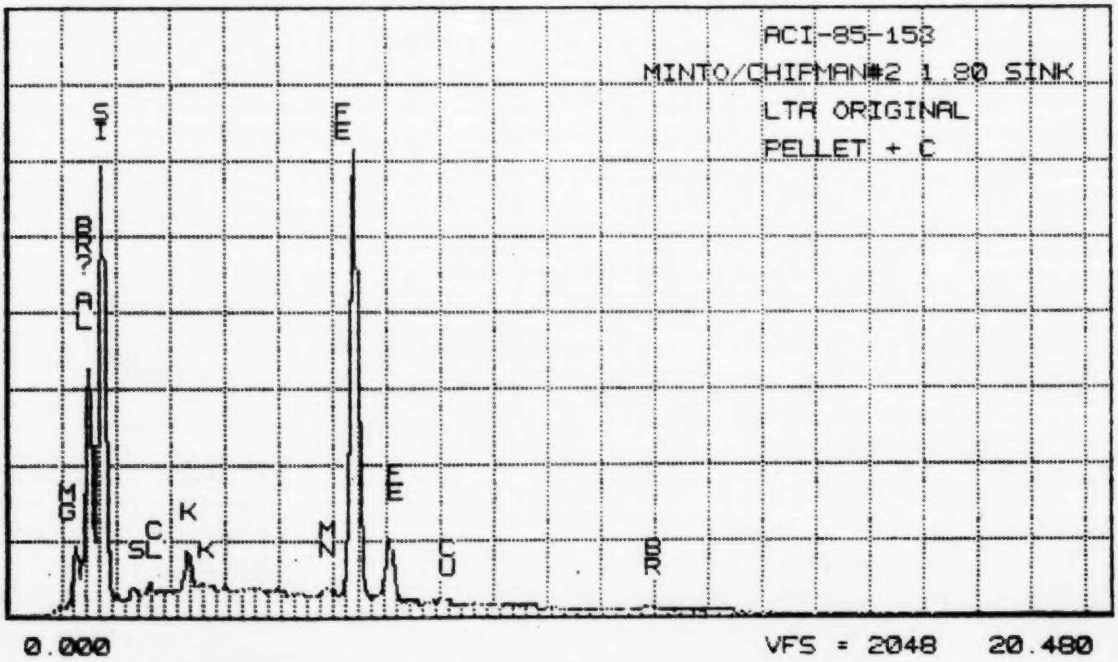


ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA ORIGINAL
PELLET + C

1

VFS = 2048
50 MINERAL: **Ch?** PHOTO#1126-09.EDX1

ATLANTIC COAL INSTITUTE THU 27-NOV-86 10:12
Cursor: 0.000keV = 0



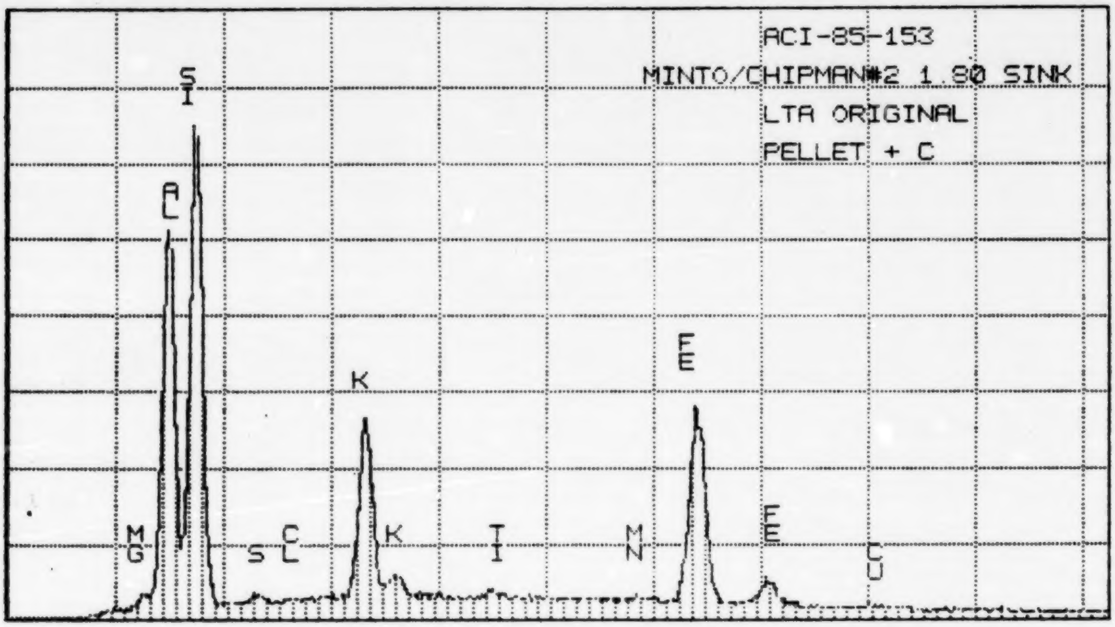
ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA ORIGINAL
PELLET + C

2

VFS = 2048
50 MINERAL: PHOTO#1126-09.EDX1

ATLANTIC COAL INSTITUTE THU 27-NOV-86 10:15

Cursor: 0.000keV = 0



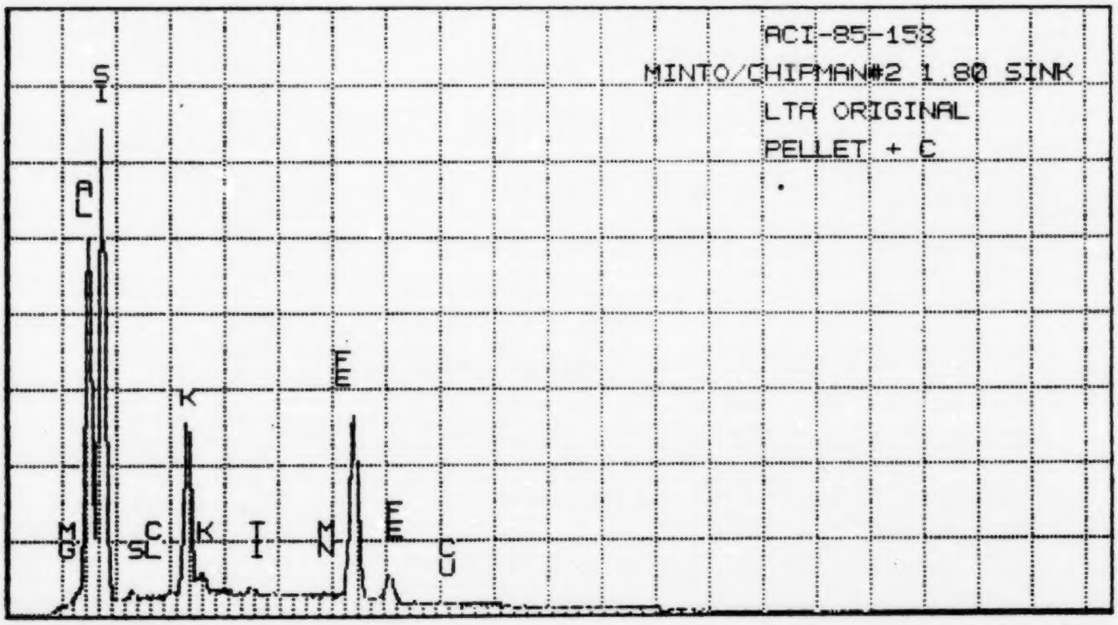
3

0.000 VFS = 2048 10.240

50 MINERAL: **I + Ti** PHOTO#1126-09.EDX2

ATLANTIC COAL INSTITUTE THU 27-NOV-86 10:18

Cursor: 0.000keV = 0



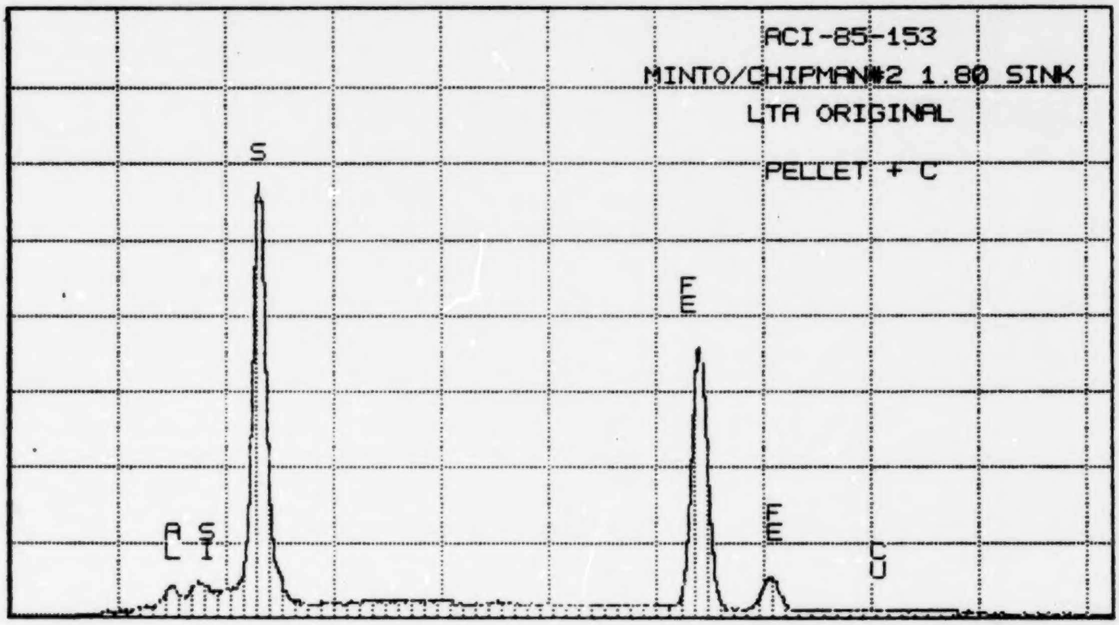
4

0.000 VFS = 2048 20.480

50 MINERAL: PHOTO#1126-09.EDX2

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:26

Cursor: 0.000keV = 0


ACI-85-153

MINTO/CHIPMAN#2 1.80 SINK

LTA ORIGINAL

PELLET + C

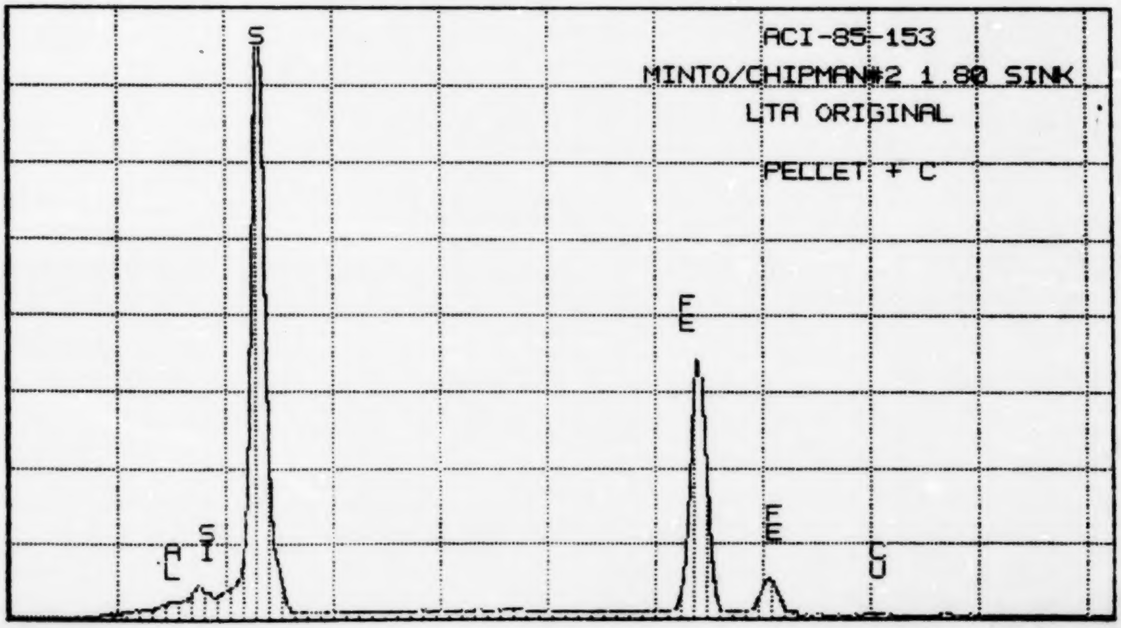
5

0.000 VFS = 4096 10.240

50 MINERAL:**P** PHOTO#1126-09,EDX3

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:28

Cursor: 0.000keV = 0


ACI-85-153

MINTO/CHIPMAN#2 1.80 SINK

LTA ORIGINAL

PELLET + C

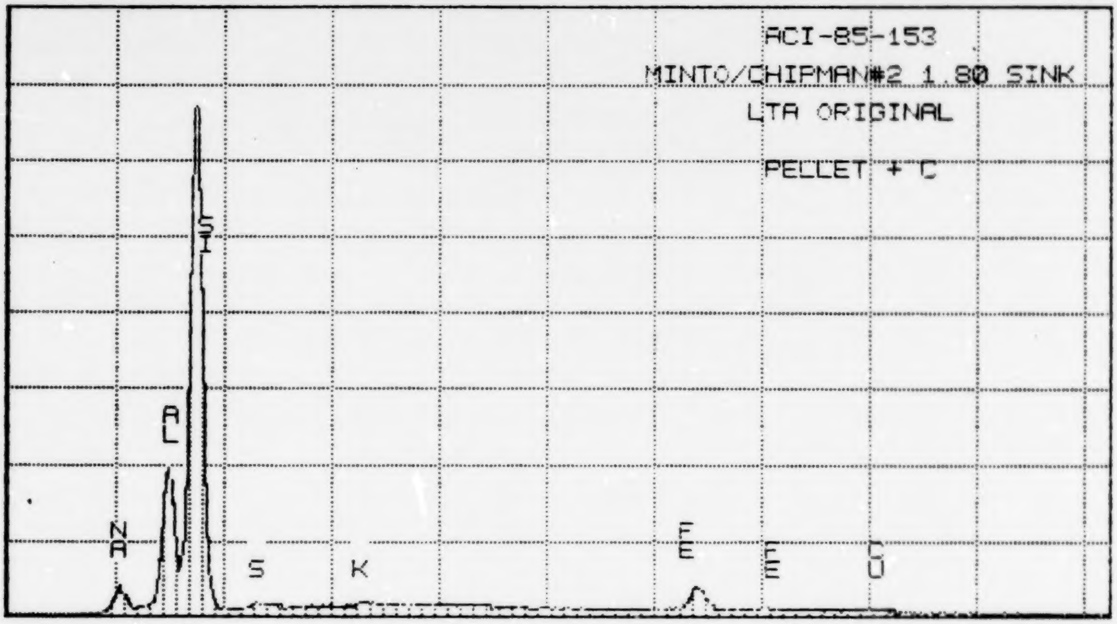
6

0.000 VFS = 8192 10.240

50 MINERAL:**P** PHOTO#1126-09,EDX4

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:30

Cursor: 0.000keV = 0



ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA ORIGINAL

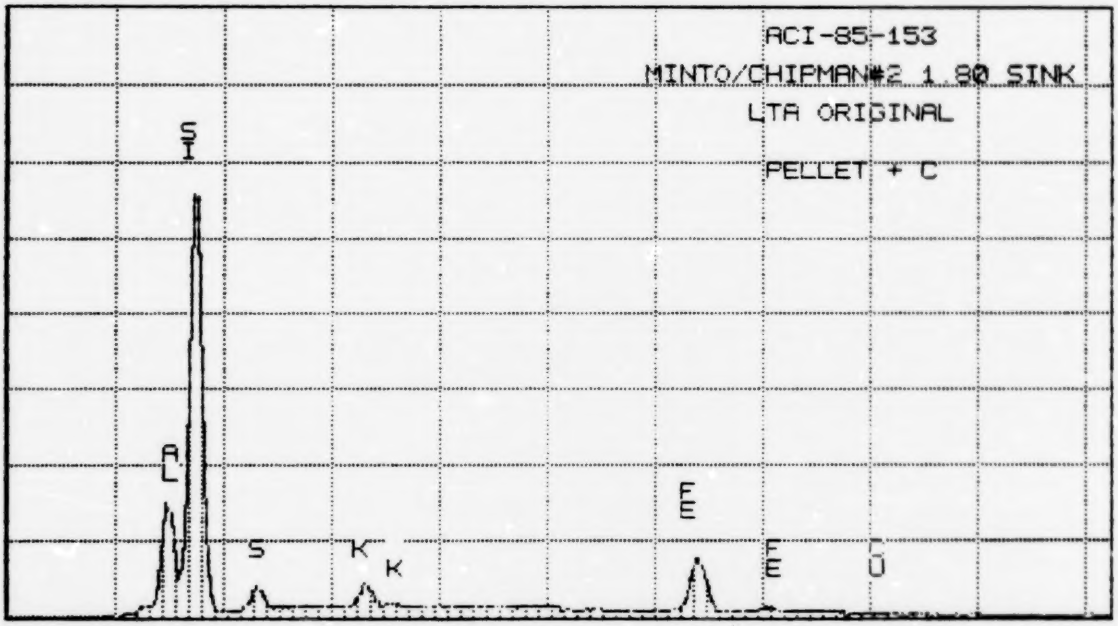
PELLET + C

7

51 MINERAL: ? PHOTO#1126-09,EDX5

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:32

Cursor: 0.000keV = 0



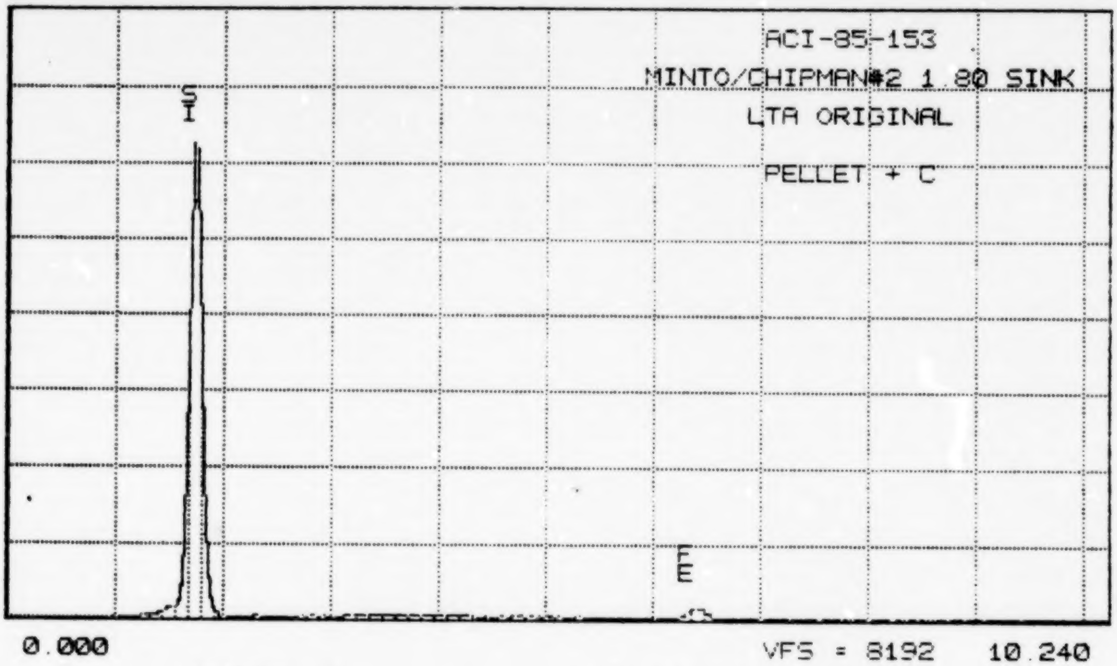
ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA ORIGINAL

PELLET + C

8

50 MINERAL: I PHOTO#1126-09,EDX6

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:34
Cursor: 0.000keV = 0



9

51 MINERAL:**Q** PHOTO#1126-09,EDX7

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:37
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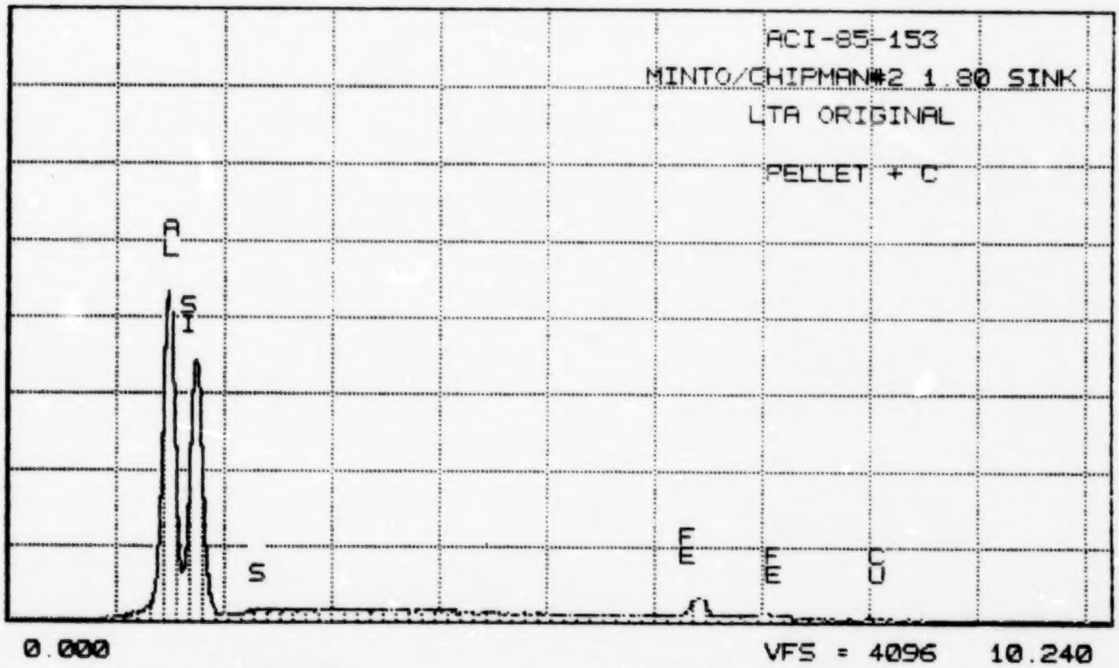
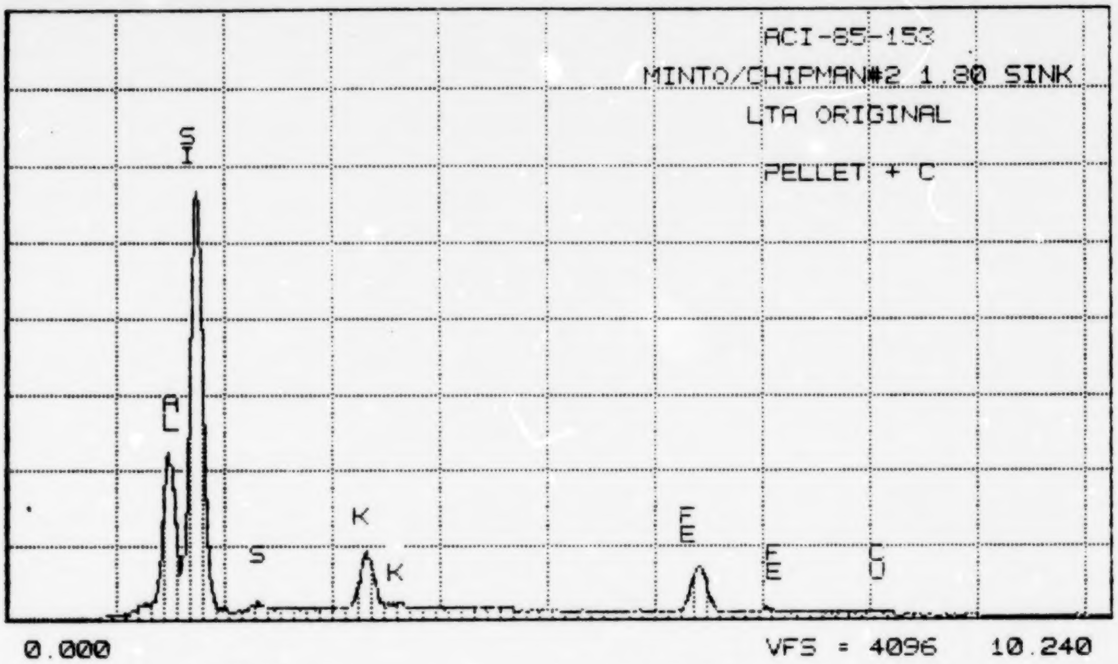


10

50 MINERAL:**K** PHOTO#1126-09,EDX8

ATLANTIC COAL INSTITUTE THU 27-NOV-86 16:39

Cursor: 0.000keV = 0

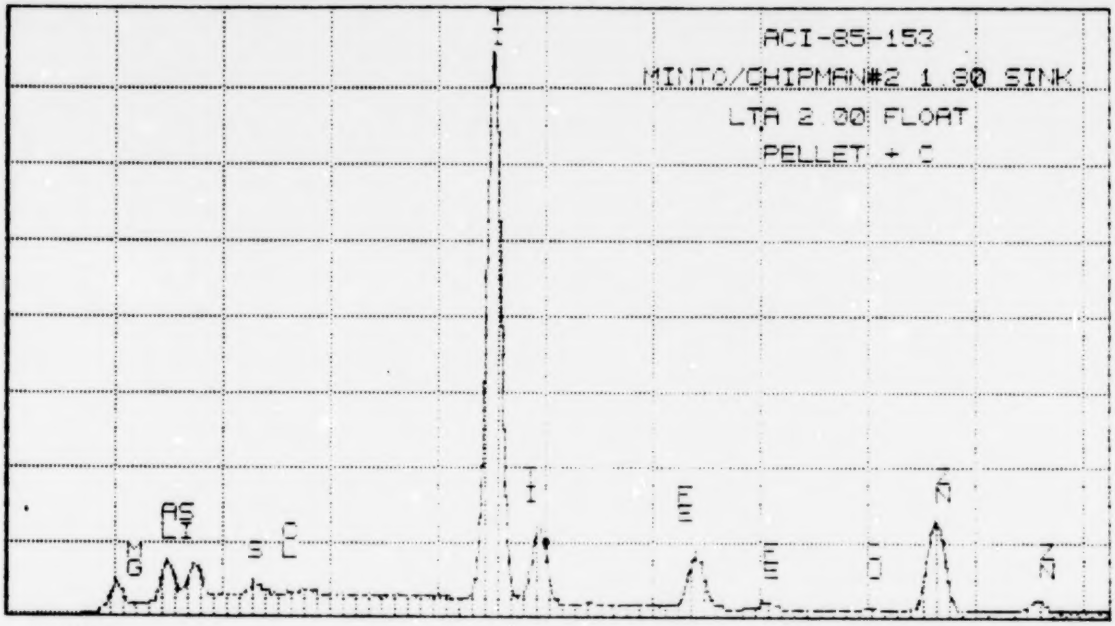


11

50 MINERAL: I PHOTO#1126-09,EDX9

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:34

Cursor: 0.000keV = 0



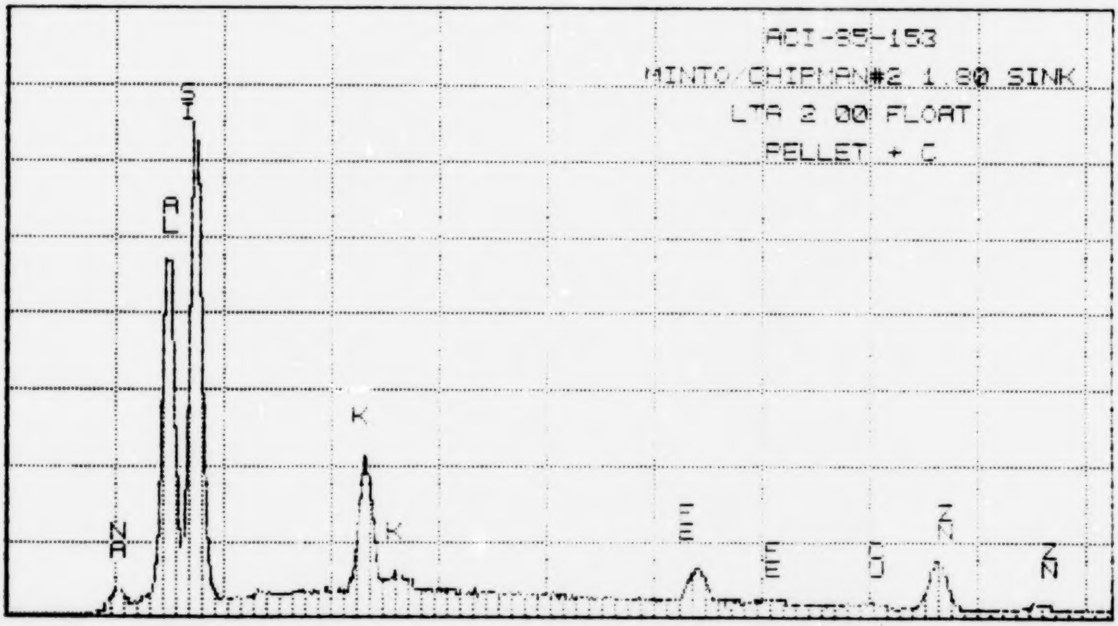
12

0.000 VFS = 4096 10.240

50 MINERAL: **R** PHOTO#1127-03.EDX1

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:36

Cursor: 0.000keV = 0



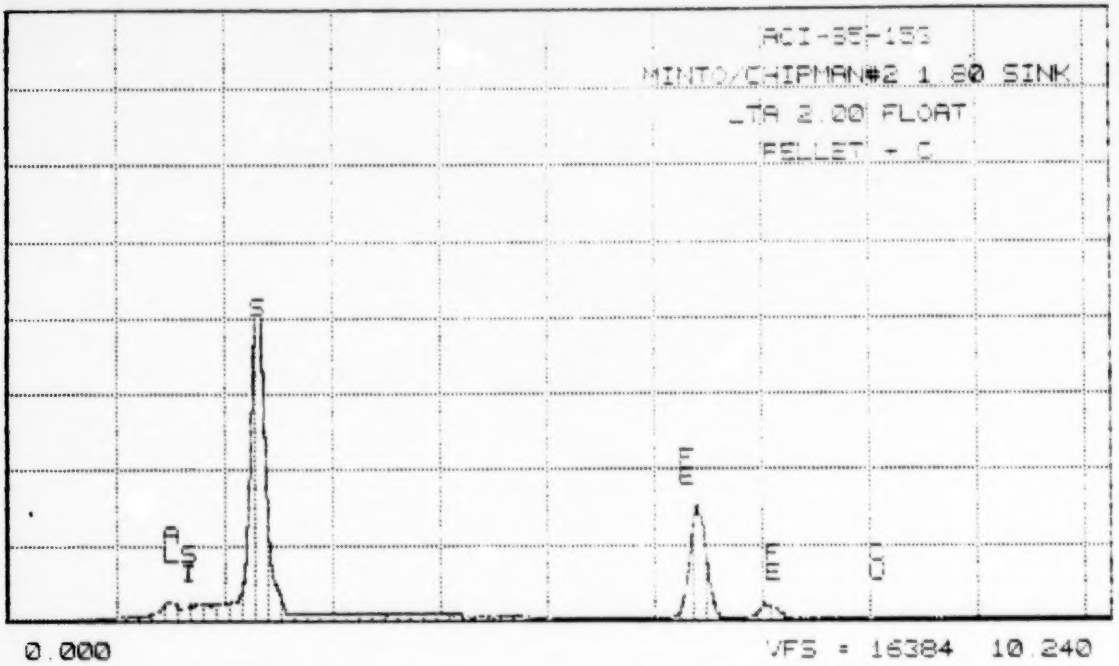
13

0.000 VFS = 2048 10.240

50 MINERAL: **I** PHOTO#1127-03.EDX2

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:38

Cursor: 0.000keV = 0

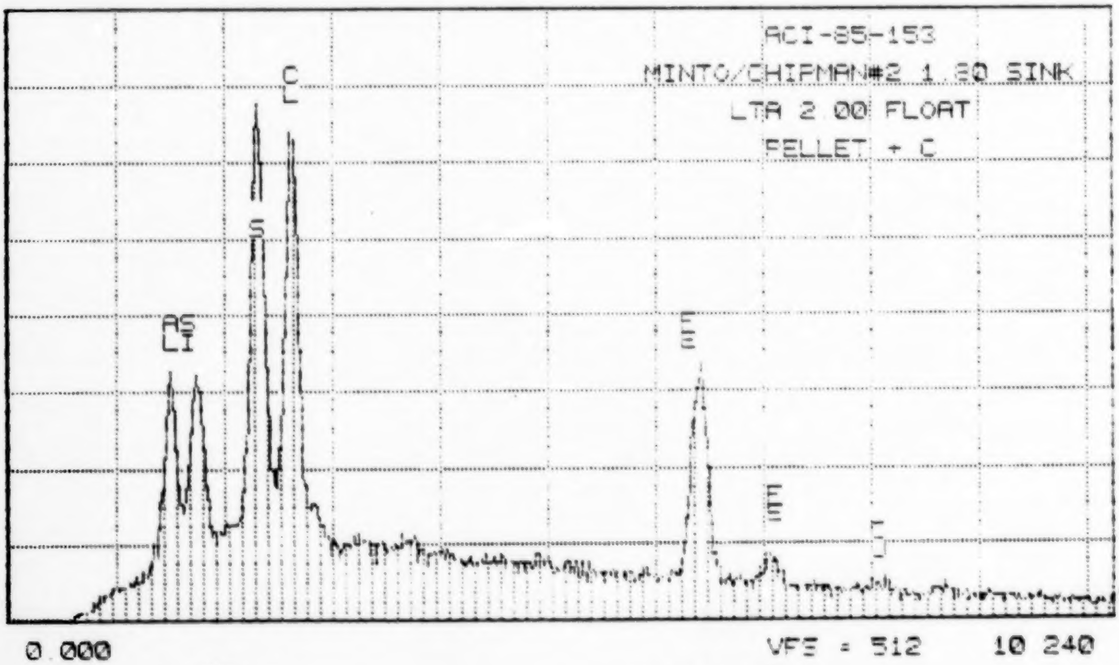


14

50 MINERAL: **P** PHOTO#1127-03.EDX3

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:40

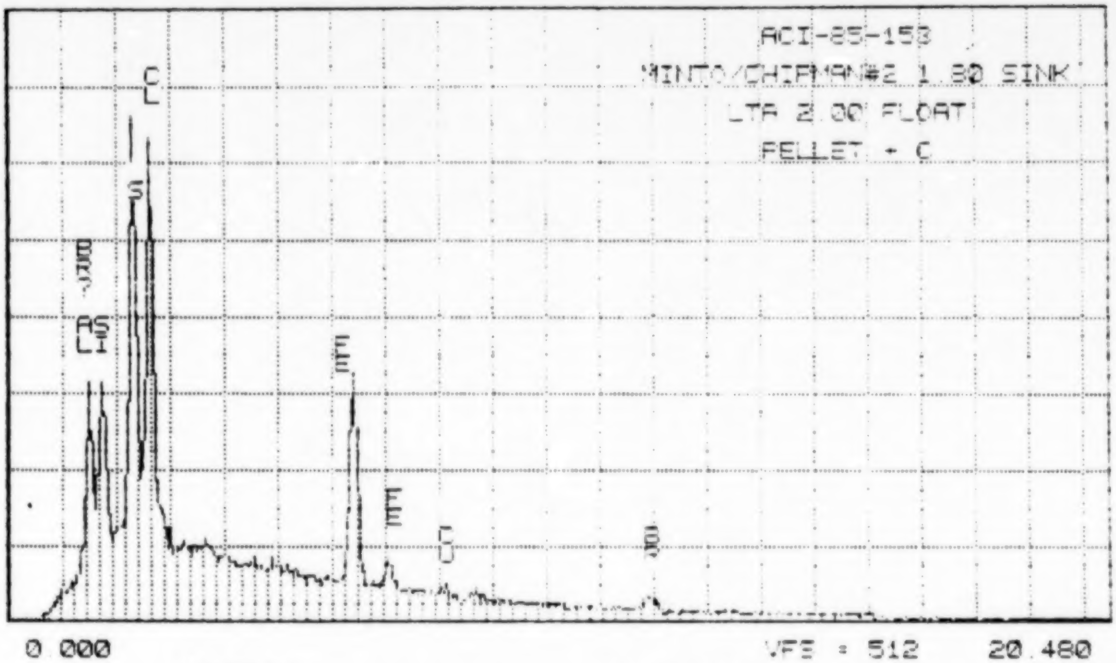
Cursor: 0.000keV = 0



15

50 **MATRIX:** PHOTO#1127-03.EDX4

ATLANTIC COAL INSTITUTE THU 27-NOV-86 14:39
Cursor: 0.000keV = 0 ROI (0) 0.000: 0.000

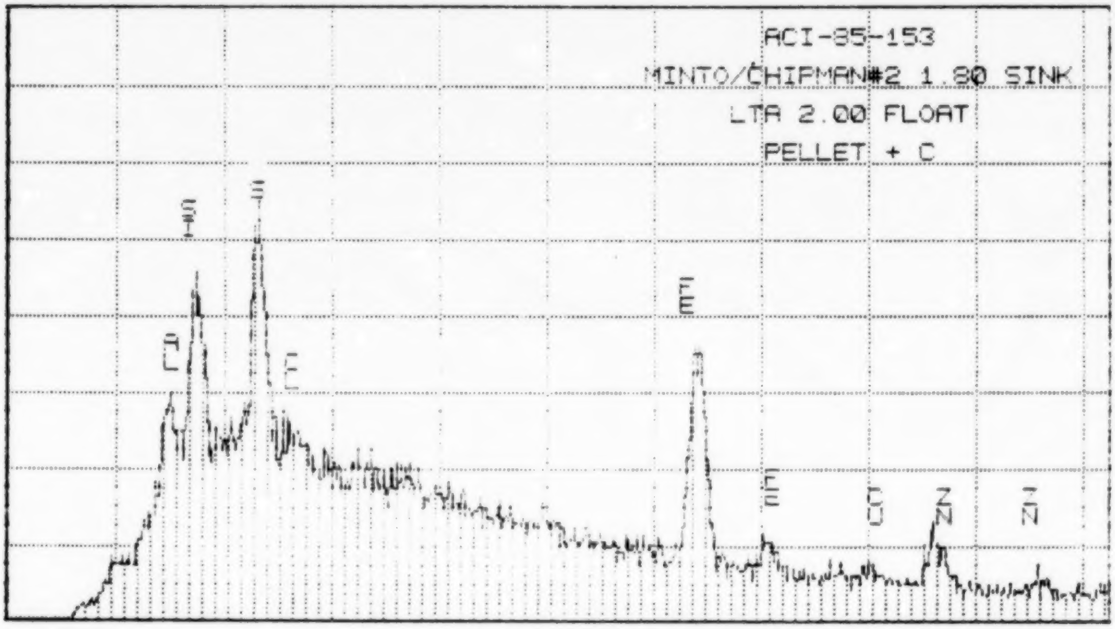


16

MATRIX: PHOTO#1127-03.EDX4 50

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:43

Cursor: 0 000keV = 0



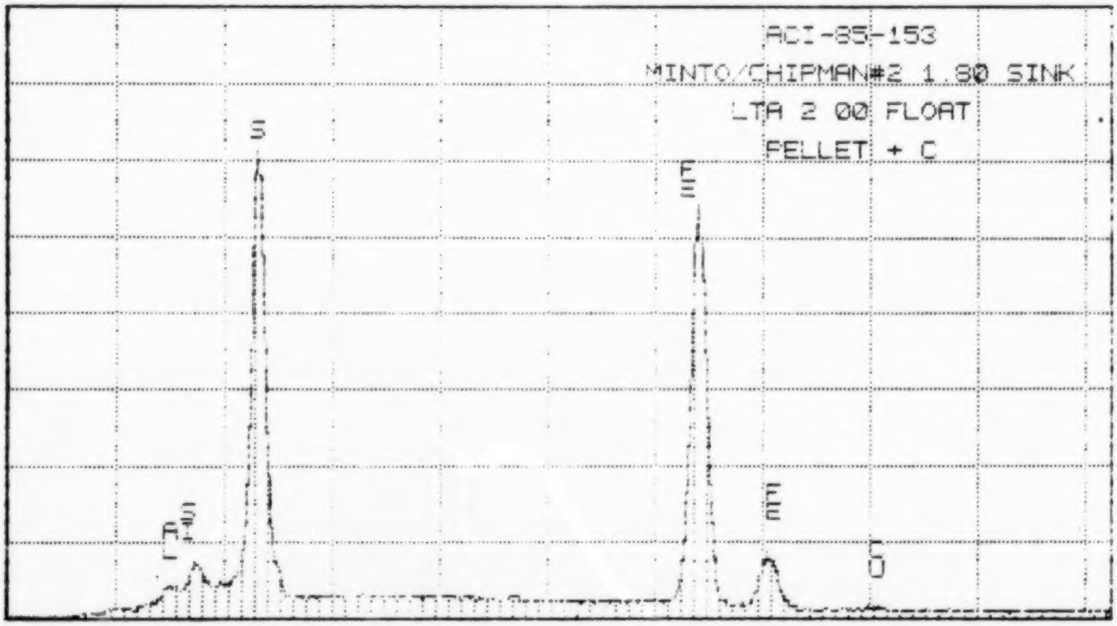
17

0.000 VFS = 256 10.240

50 MATRIX: PHOTO#1127-03,EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:45

Cursor: 0.000keV = 0

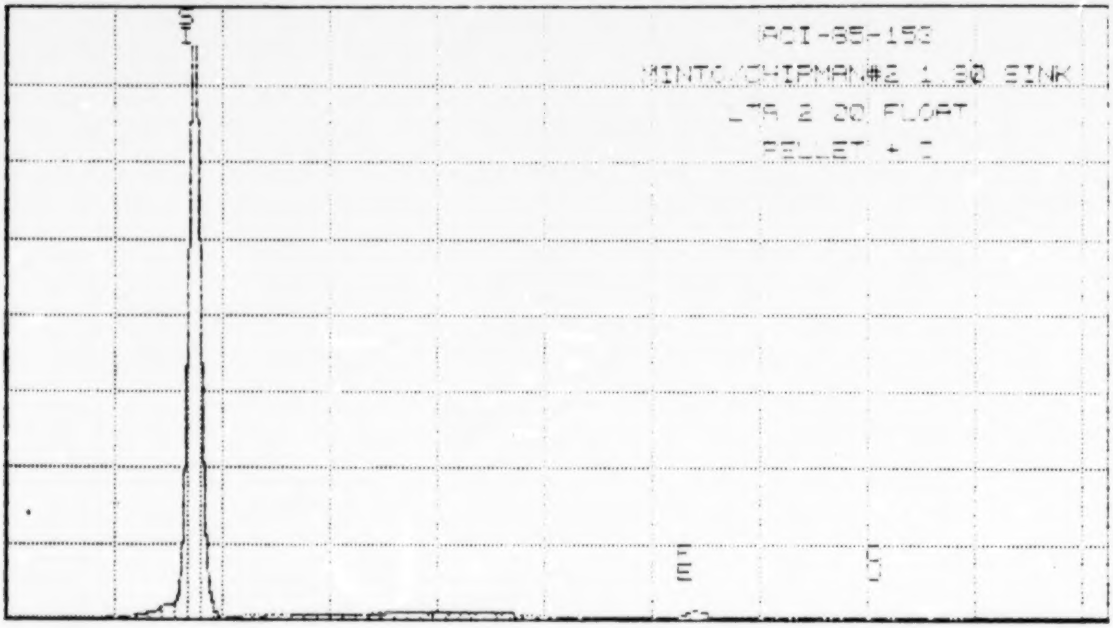


18

0.000 VFS = 2048 10.240

50 MINERAL: P PHOTO#1127-03,EDX6

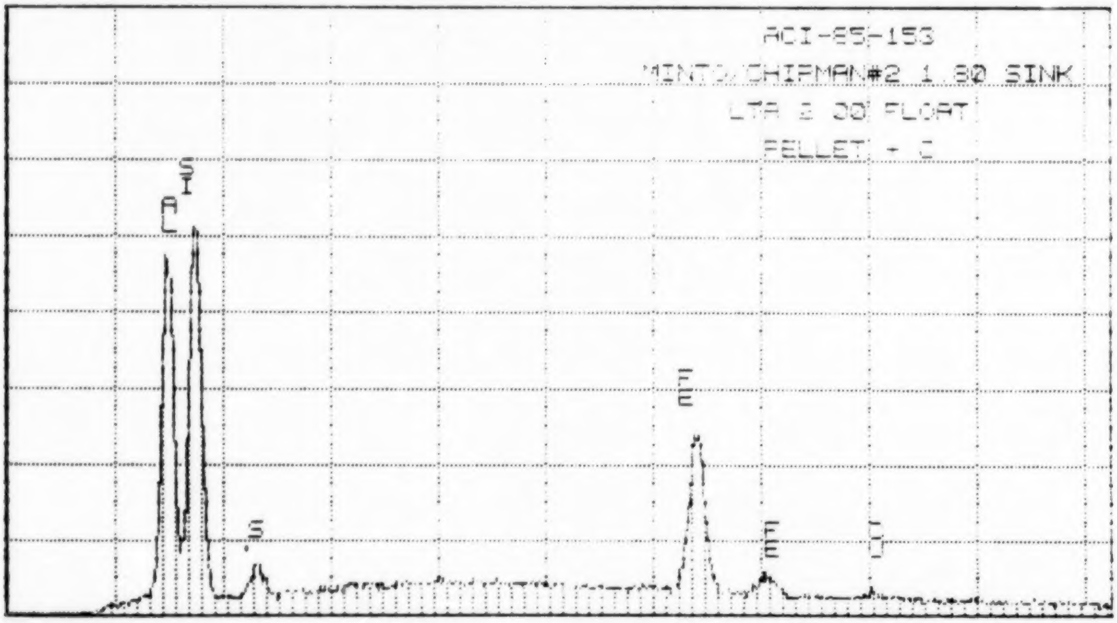
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:47
Cursor: 0.000keV = 0



0.000 VFS = 8192 10.240
50 MINERAL: **Q** PHOTO#1127-03.EDX7

19

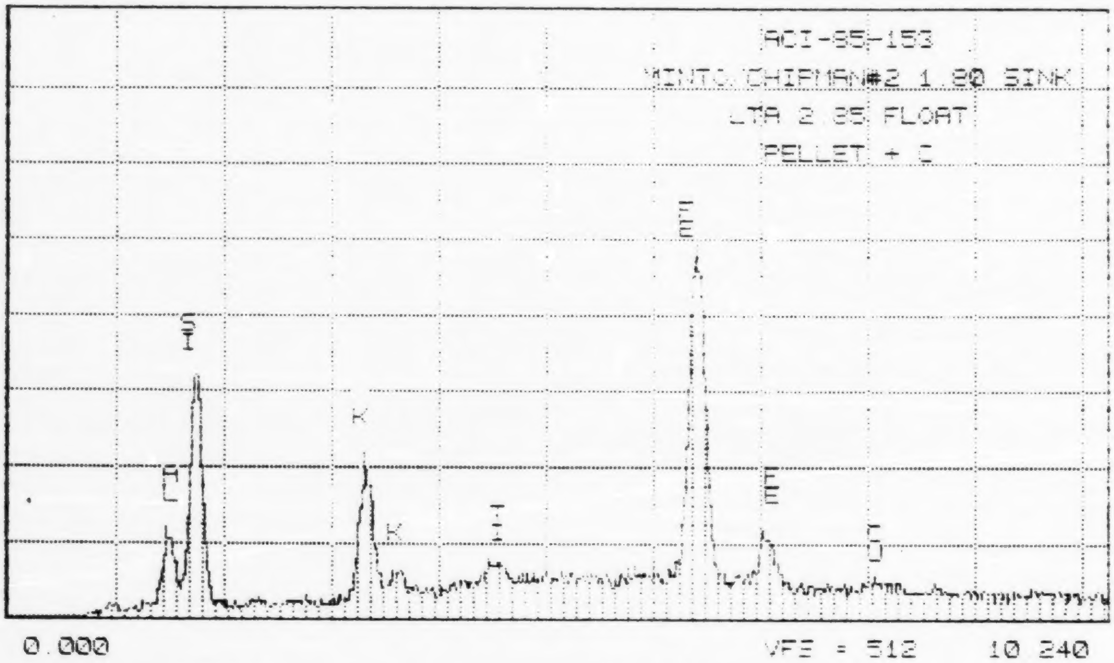
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:49
Cursor: 0.000keV = 0



0.000 VFS = 1024 10.240
50 MINERAL: **K** PHOTO#1127-03.EDX8

20

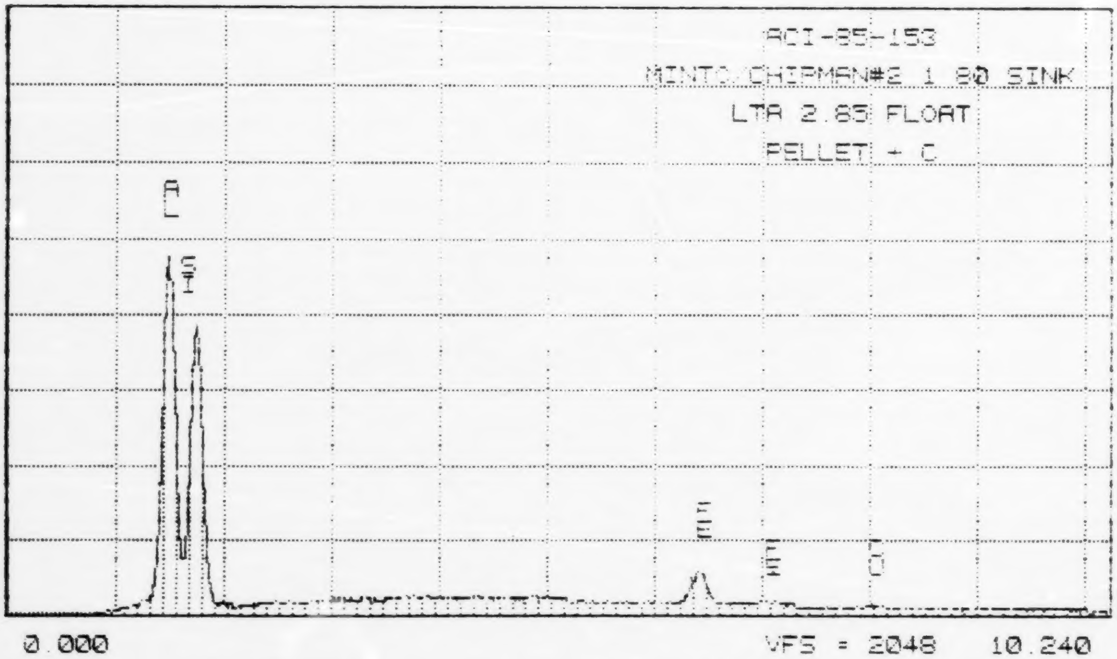
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:56
Cursor: 0.000keV = 0



21

50 MINERAL:
PHOTO#1127-09.EDX1

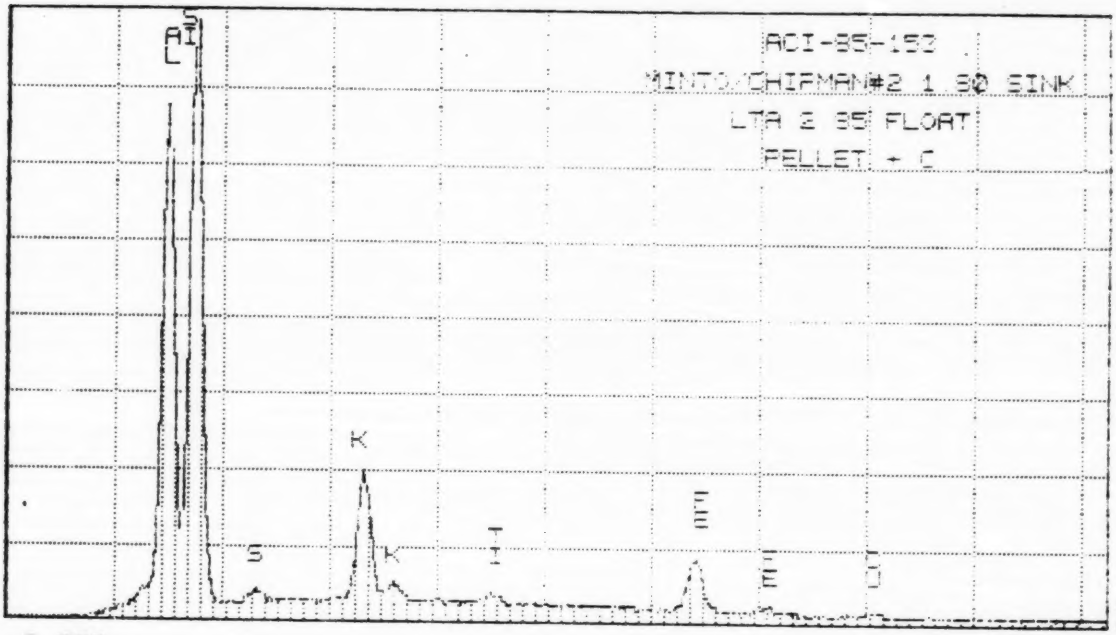
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 09:58
Cursor: 0.000keV = 0



22

50 MINERAL:K
PHOTO#1127-09.EDX2

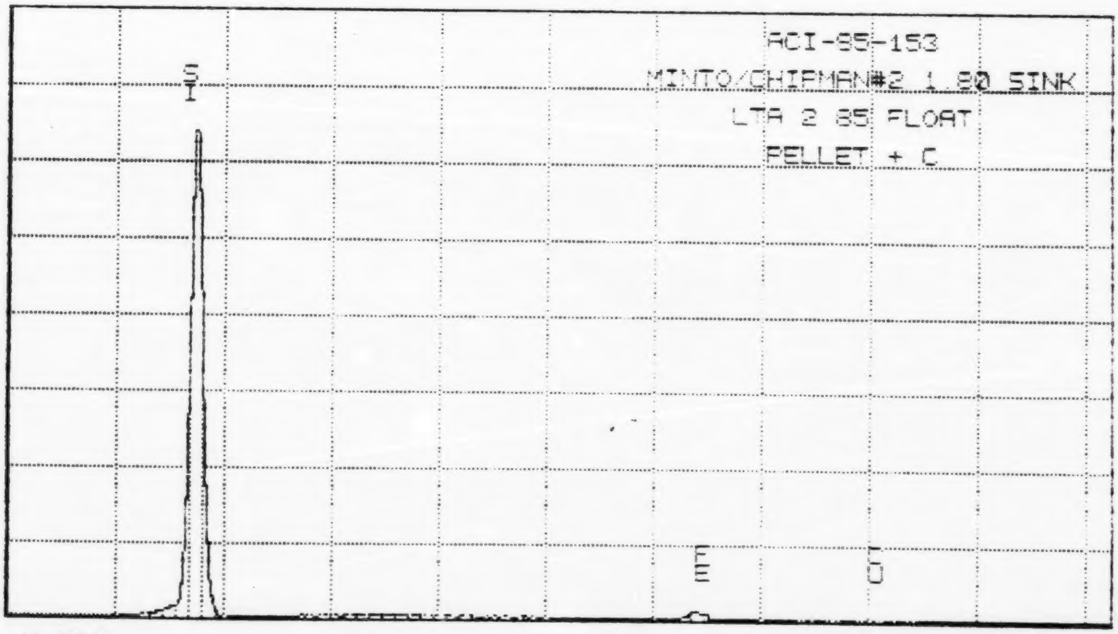
ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:00
Cursor: 0.000keV = 0



23

0.000 VFS = 2048 10.240
50 MINERAL: **I + TI** PHOTO#1127-09.EDX3

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:02
Cursor: 0.000keV = 0

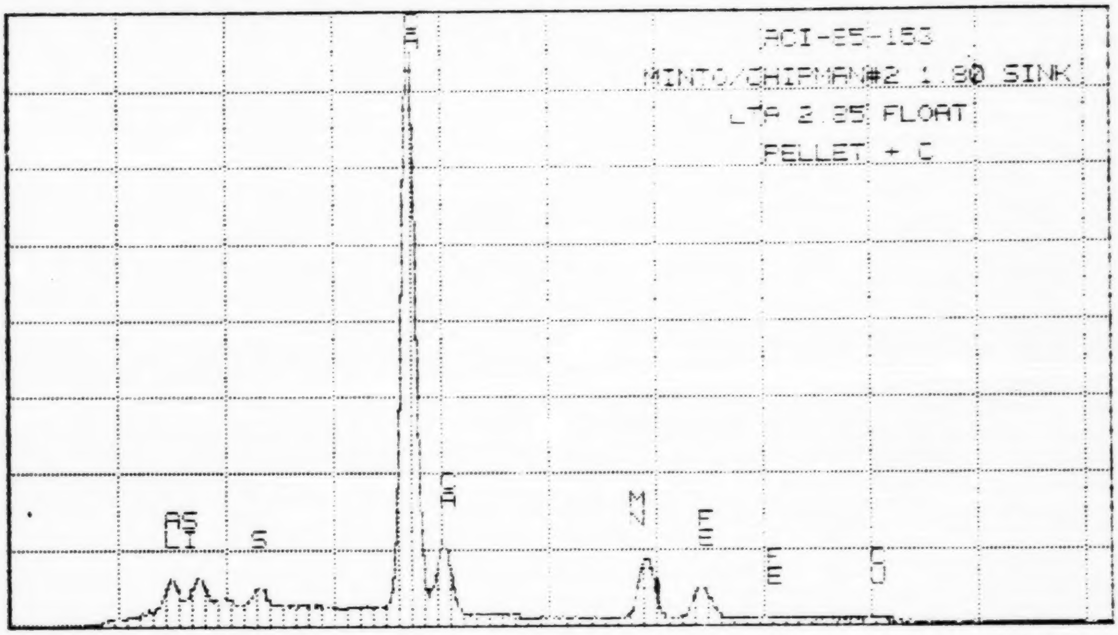


24

0.000 VFS = 8192 10.240
50 MINERAL: **Q** PHOTO#1127-09.EDX4

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:05

Cursor: 0.000keV = 0



ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA 2.85 FLOAT
PELLET + C

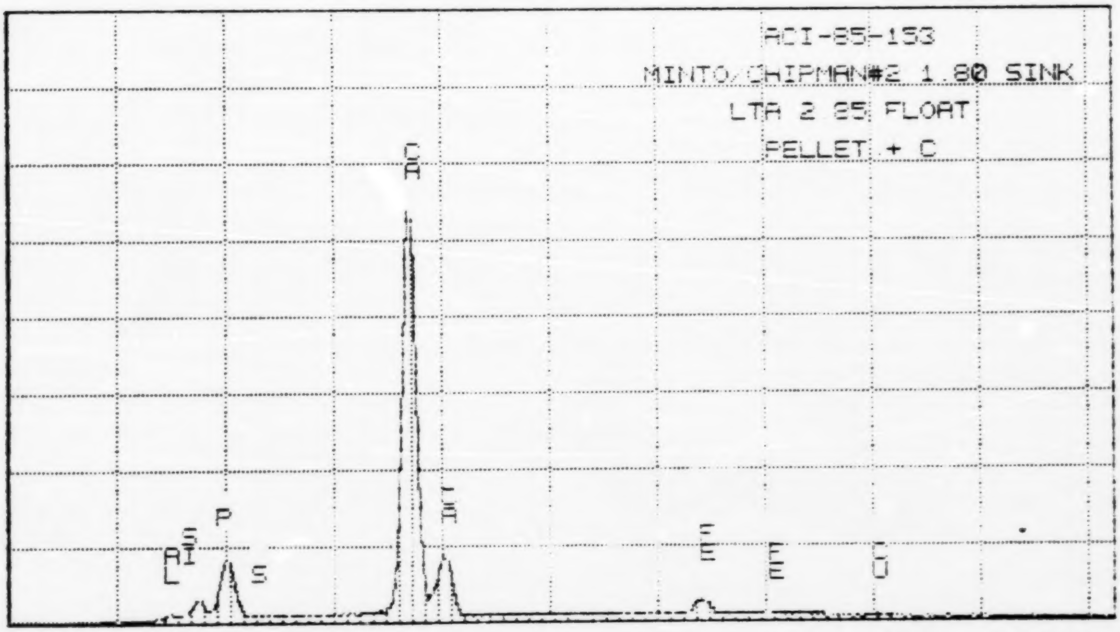
25

0.000 VFS = 4096 10.240

50 MINERAL: **C** PHOTO#1127-09.EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:07

Cursor: 0.000keV = 0



ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA 2.85 FLOAT
PELLET + C

26

0.000 VFS = 4096 10.240

50 MINERAL: **Ap** PHOTO#1127-09.EDX6

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:09
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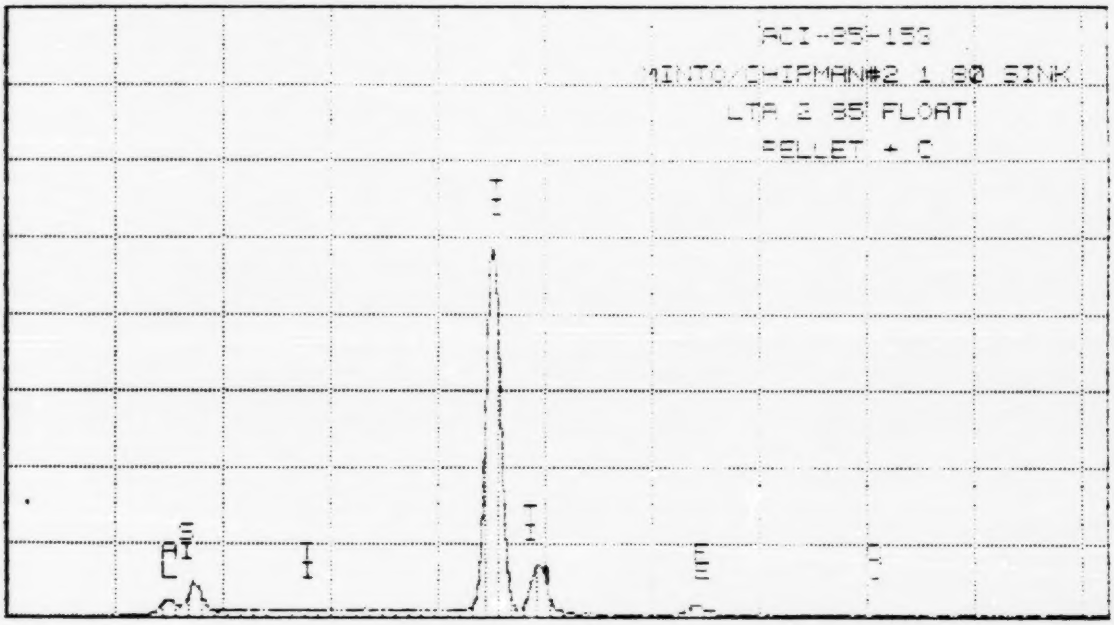

ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA 2.85 FLOAT
PELLET + C

27

0.000 VFS = 8192 10.240
50 MINERAL:**R** PHOTO#1127-09.EDX7

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:11
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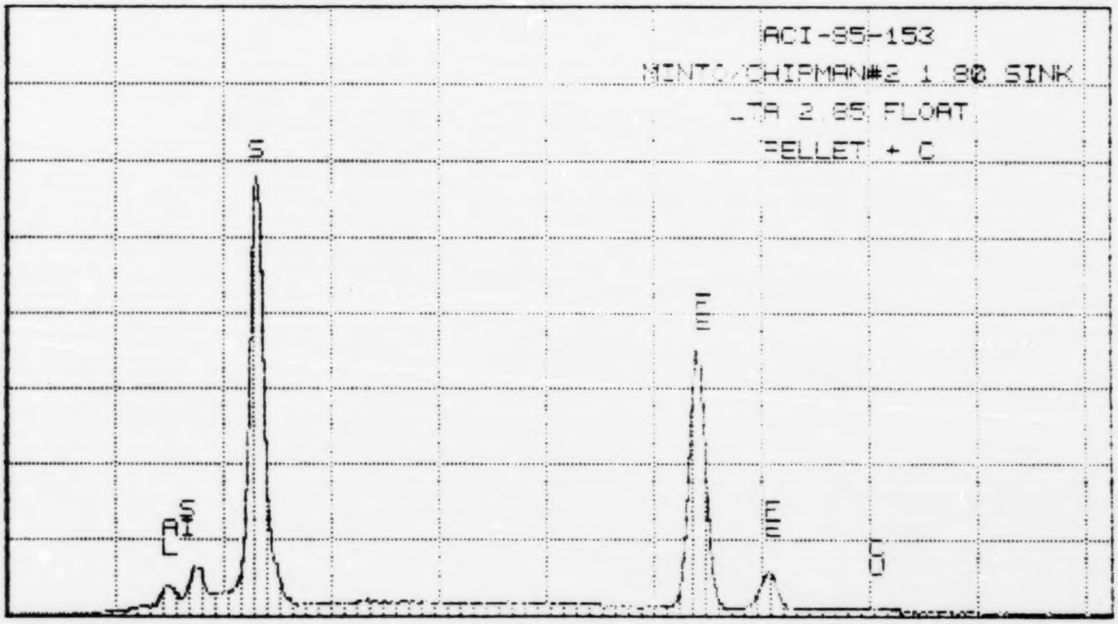
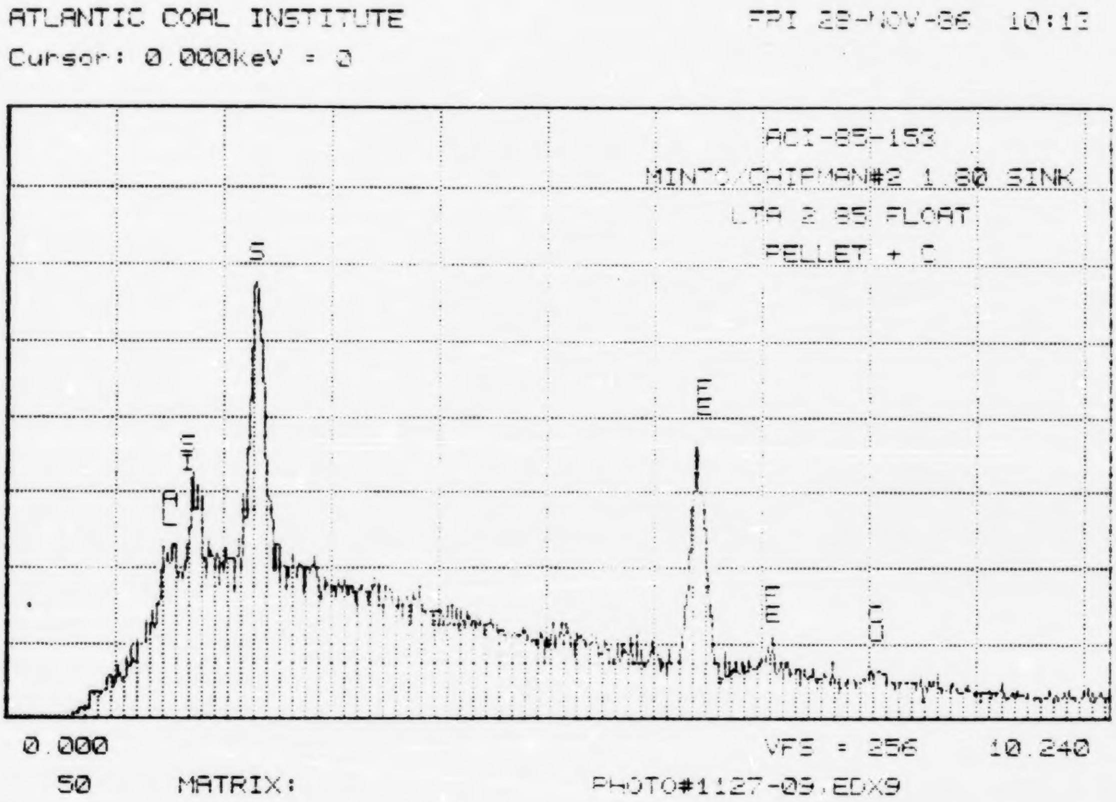


ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA 2.85 FLOAT
PELLET + C

28

0.000 VFS = 4096 10.240
50 MINERAL:**P** PHOTO#1127-09.EDX8



ATLANTIC COAL INSTITUTE FRI 28-NOV-86 10:13
Cursor: 0.000keV = 0

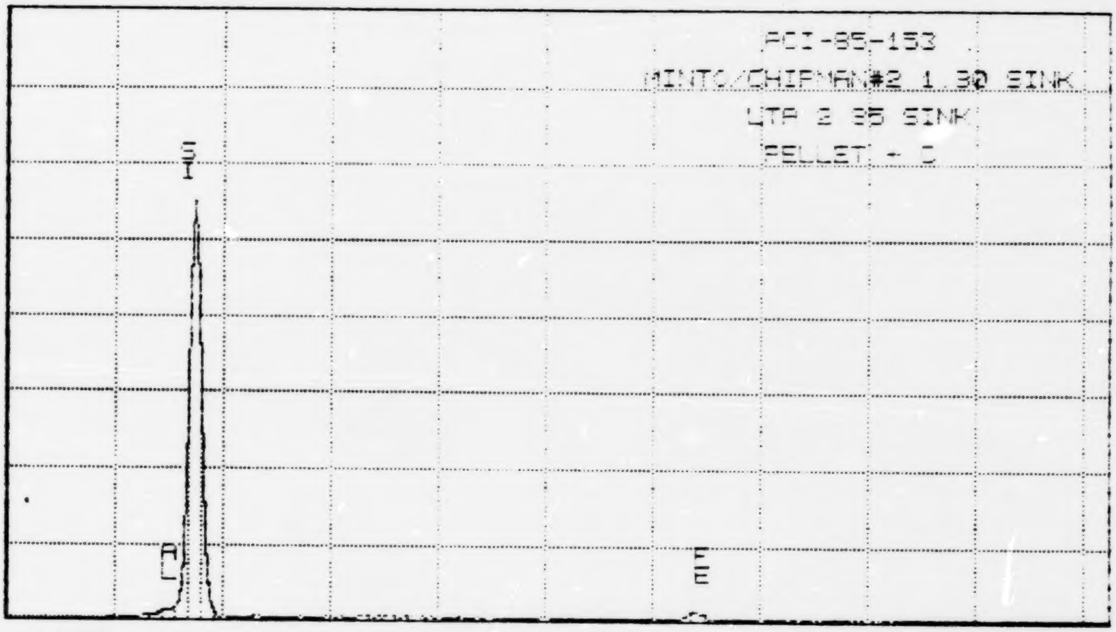
ACI-85-153
MINTO/CHIPMAN#2 1.80 SINK
LTA 2.85 FLOAT
PELLET + C

0.000 VFS = 256 10.240
50 MATRIX: PHOTO#1127-09.EDX9

29

ATLANTIC COAL INSTITUTE   FRI 28-NOV-86 12:03

Cursor: 0.000keV = 0



30

0.000   VFS = 8192   10.240

50   MINERAL: **Q**   PHOTO#1127-10.EDX1

ATLANTIC COAL INSTITUTE   FRI 28-NOV-86 12:05

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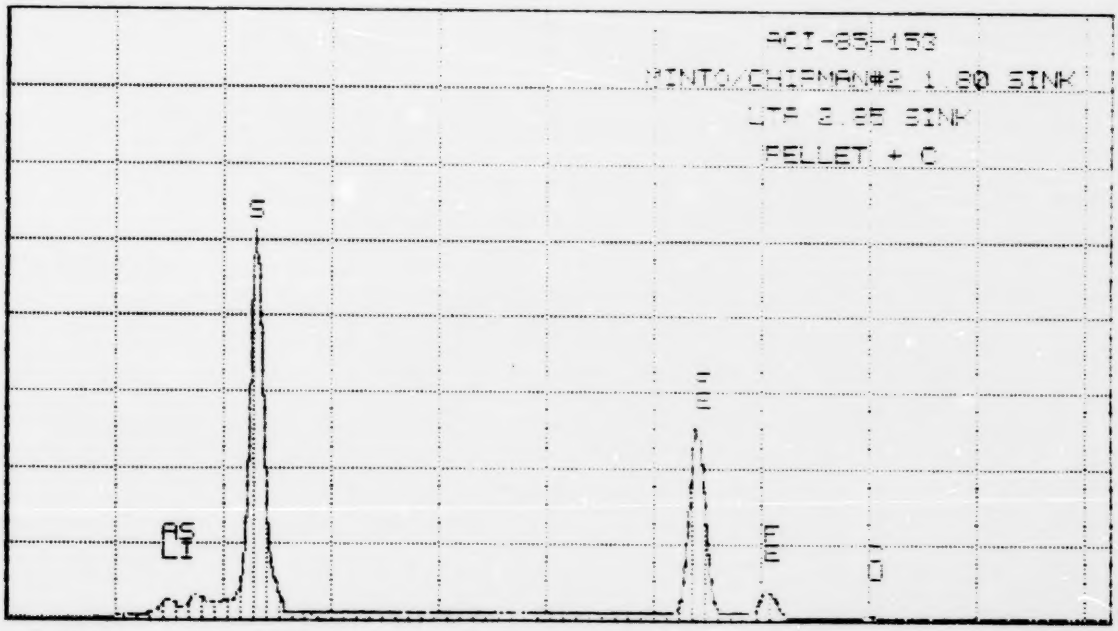

31

0.000   VFS = 8192   10.240

50   MINERAL: **P**   PHOTO#1127-10,EDX3

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 12:07

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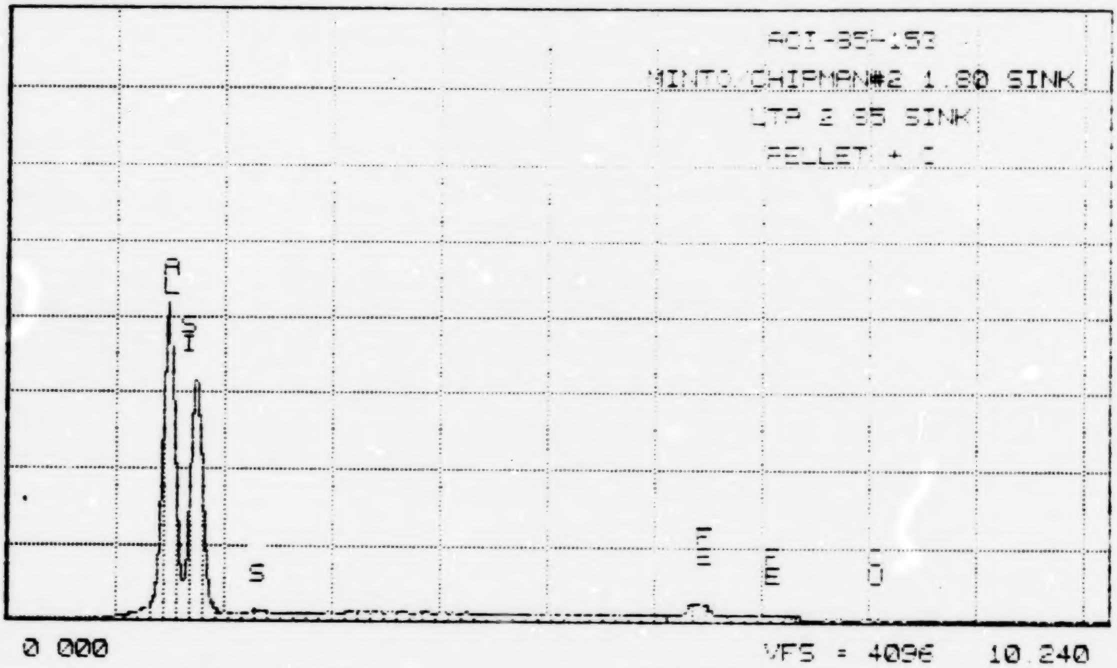

32

50 MINERAL: **K** PHOTO#1127-10.EDX4

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 12:10

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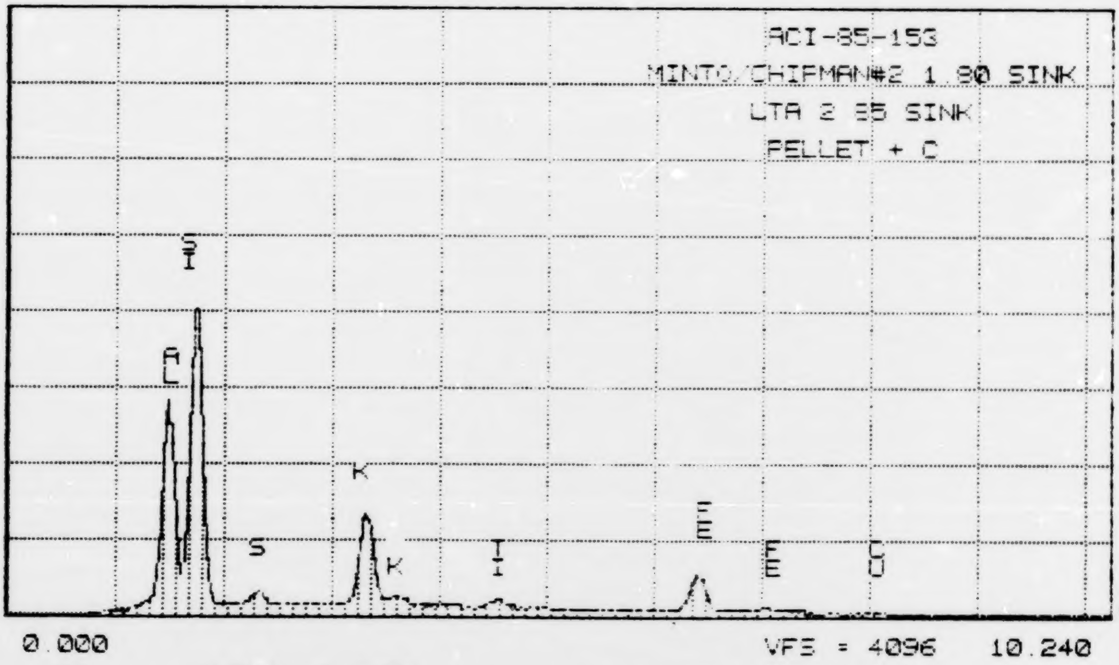

33

50 MINERAL: **I + TI** PHOTO#1127-10.EDX4

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 12:12

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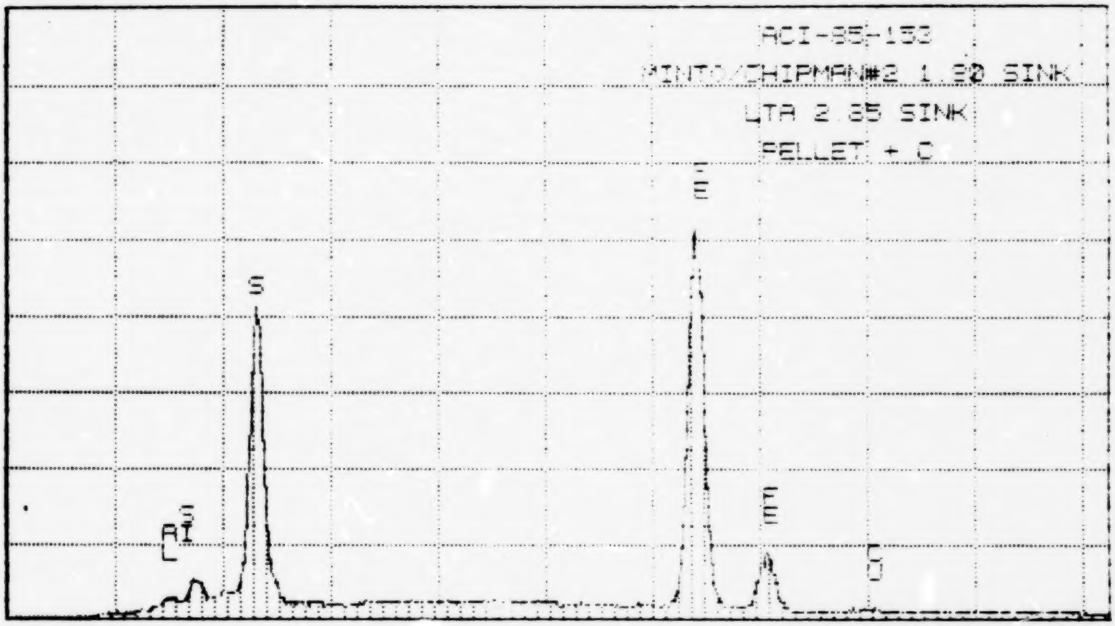


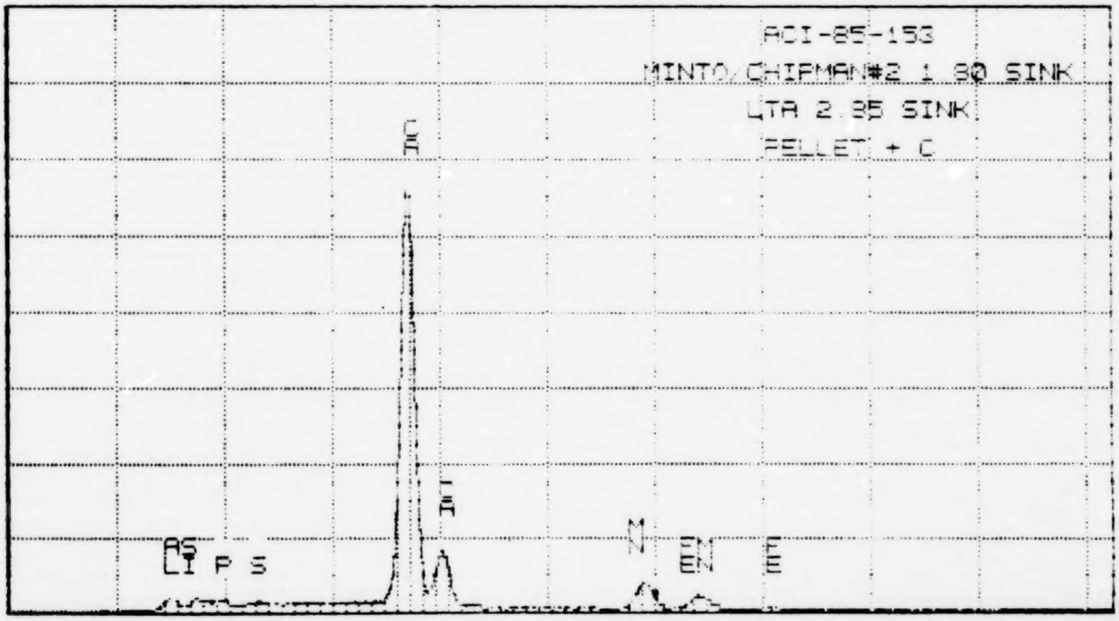
34

0.000 VFS = 2048 10.240

50 MINERAL: PHOTO#1127-10.EDX5

ATLANTIC COAL INSTITUTE FRI 28-NOV-86 12:14

Cursor: 0.000keV = 0



35

0.000 VFS = 8192 10.240

50 MINERAL: C PHOTO#1126-10.EDX6